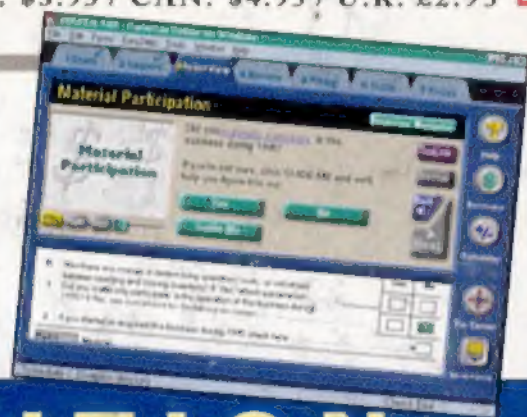




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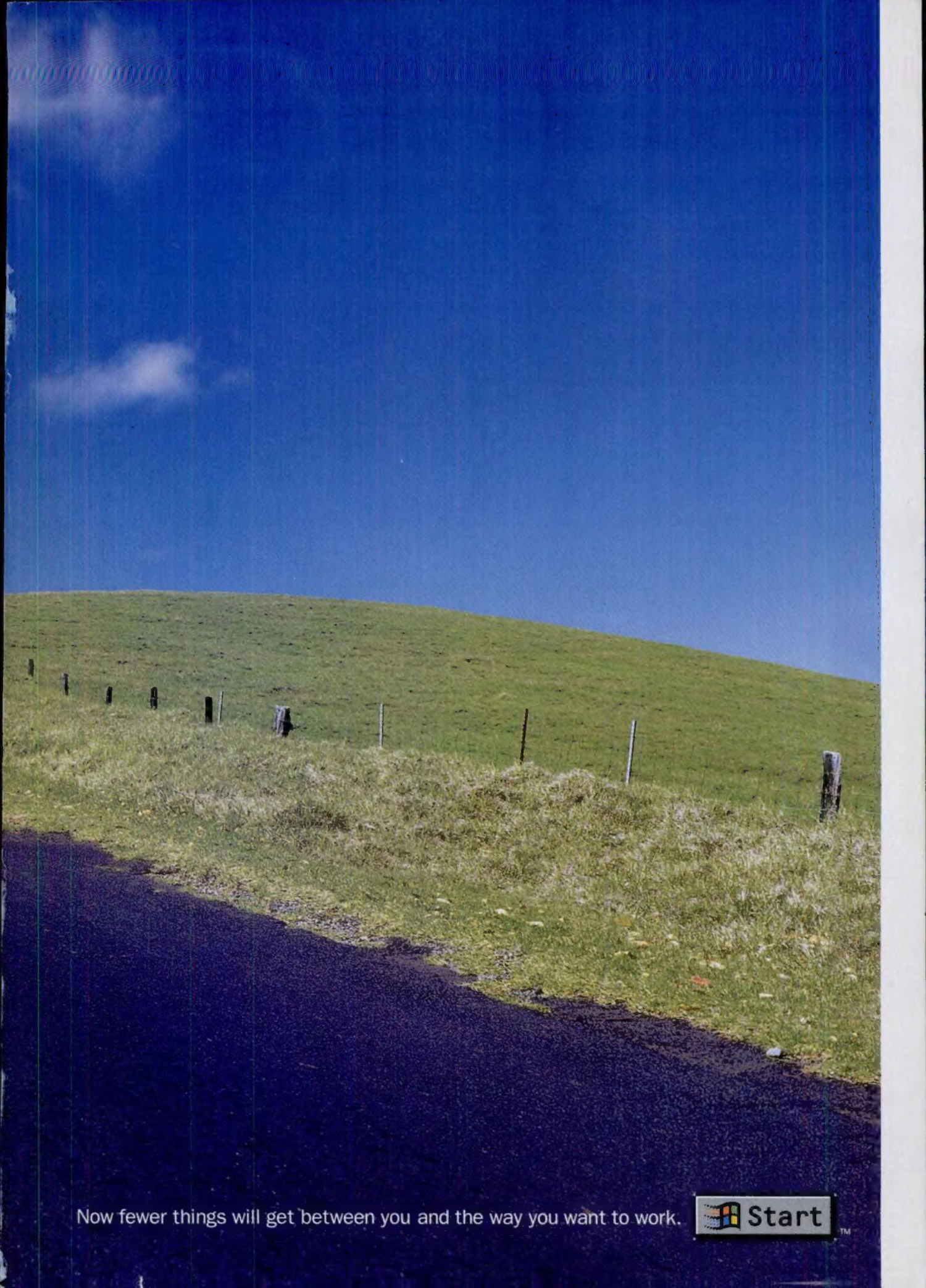
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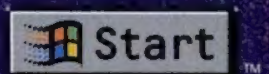


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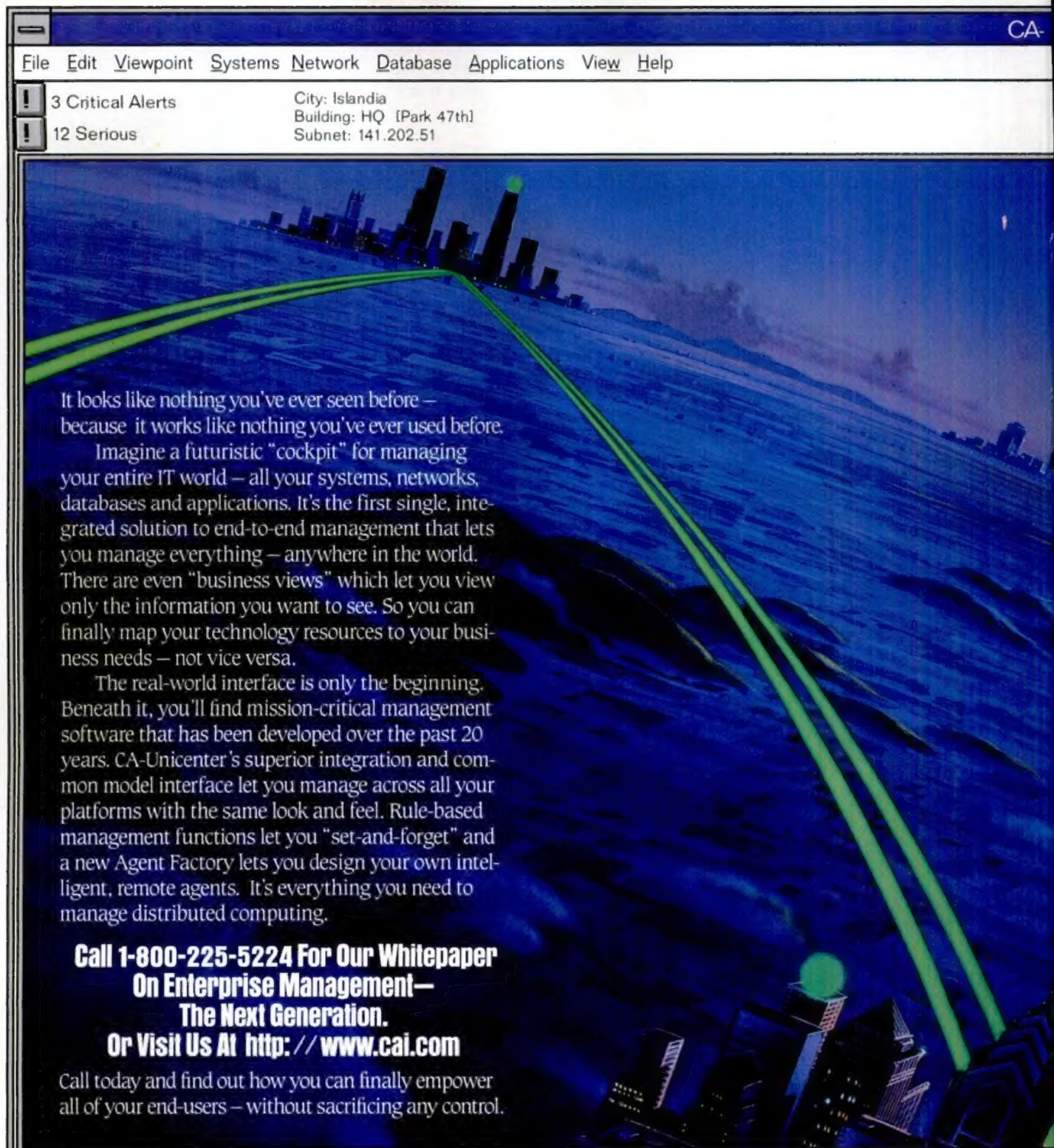




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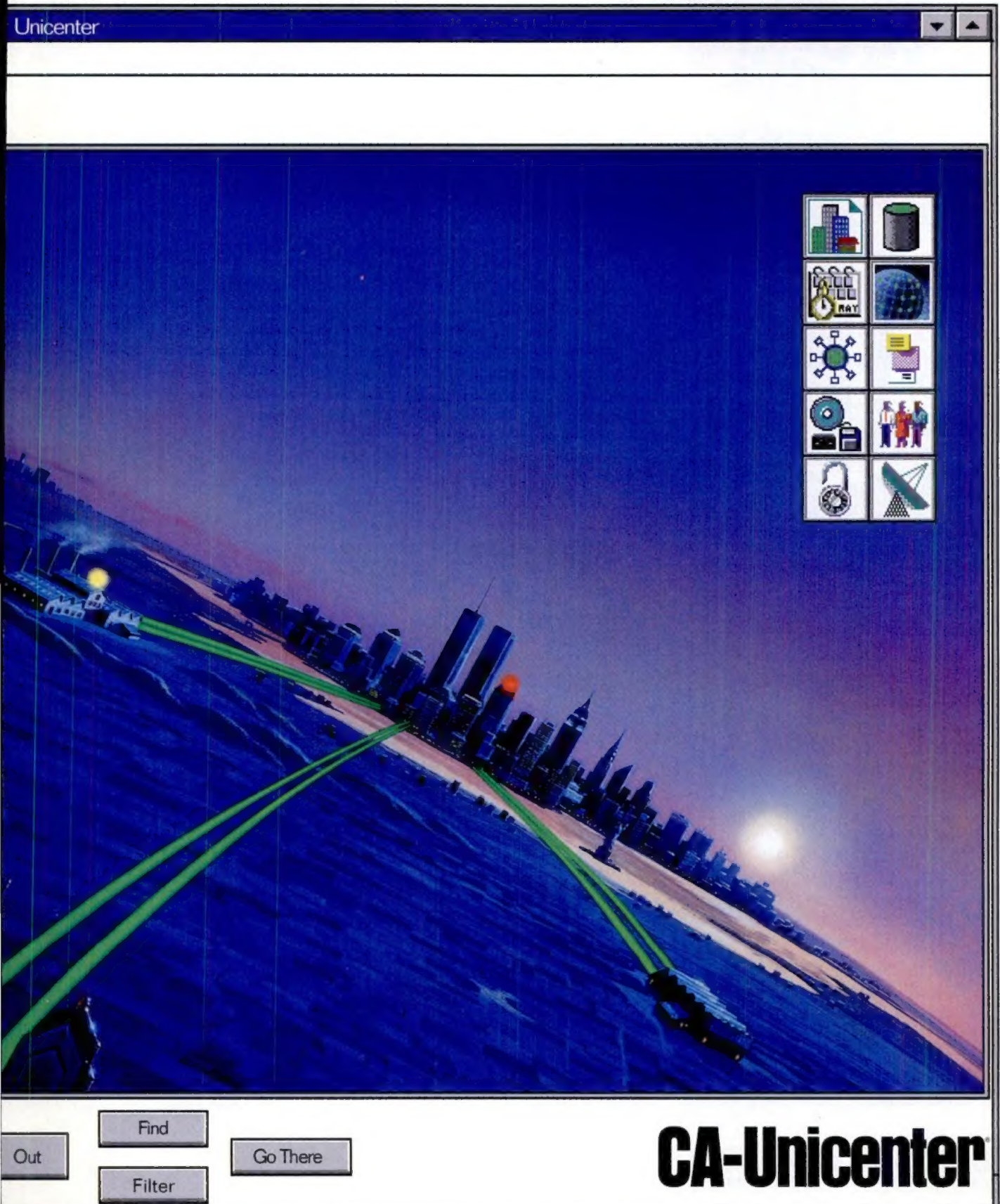
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Inside

For PC buyers hungry for the ultimate in desktop Power, 1996 promises to be a very rewarding year. The introduction of ever more powerful systems is coming at an increasing pace, bringing a parade of new systems and features that threaten to

overwhelm even the most insatiable power user.

For example, those aching for the ultimate in PC Power can now choose among new lines of machines for not one but two series of top-end Intel processors—the Pentium and Pentium Pro.

Making sense of the many choices now available is the task of our PCs team, headed by project leader Rich Fisco and associate

team found that systems based on both microprocessor families offer the incremental performance gains at the expected price premiums over previous generations of Intel chips. The tests confirmed our earlier findings that the Pentium Pro systems are best suited for those running true 32-bit operating systems and applications, particularly in the areas of CAD, image editing, desktop publishing, and the like,



Our PCs team gets a feel for power at PC Labs.

editor Carol Venezia. At *PC Magazine Labs*, their team benchmark-tested 31 systems boasting one of the new Pentium chips, eight running at 150 MHz and 23 at 166 MHz, plus 11 Pentium Pro 150-MHz systems. For good measure they also looked at four 200-MHz Pentium Pro machines.

Running the newest versions of Ziff-Davis's industry-standard PC benchmark tests plus *PC Magazine's* own suite of 32-bit workstation-class applications tests, the

like, while the new top-end Pentium machines offer the most benefit to the typical Windows 95 user, who lives in a world of mixed 16- and 32-bit applications.

While Pentium buyers can choose among the new systems based on the depths of their pockets, potential buy-

ers of the supposedly workstation-class Pentium Pro PCs have some hard choices to make. We found very few systems builders have surrounded the new chips with the memory, graphics, and peripherals to take full advantage of the processing capabilities.

But, of course, there's much more to the story. To find which of the latest PC behemoths offers the most bang for your buck, turn to our feature "Two Paths to Power." And *bon appétit*.—**Jake Kirchner**

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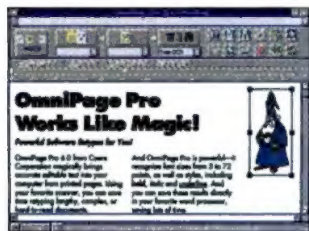
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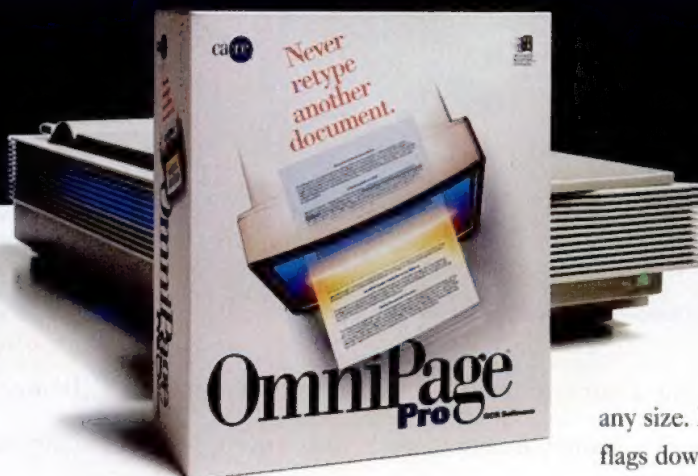
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UP FRONT

Inside

More power to you4

Letters

Is Micron or Microsoft to blame?19

Trends

- Netscape's plug-in parade
- Real-time Web video, seriously
- Side-stepping the phone company
- Fault-tolerant notebook screens.....31

Pipeline

Learning to dance with the elephants34



Notebook, printer, scanner: The Canon NoteJet IIIcx (page 39).

First Looks

- NEC MultiSpin 4x4
- AirCommunicator Lite
- AuthorSoft 3.1
- SmartSuite 96 Edition for Windows 95.....39

Second Looks

Finding lost data in Quicken 5.073

COLUMNISTS

Michael J. Miller

From the Editor-in-Chief.....29

Bill Machrone

Engineers: The Next Generation.....85

John C. Dvorak

PC Bloopers '9689
Inside Track.....91

Jim Seymour

The Evolved Web ...
Someday93

Bill Howard

Accessorizing Your PC95

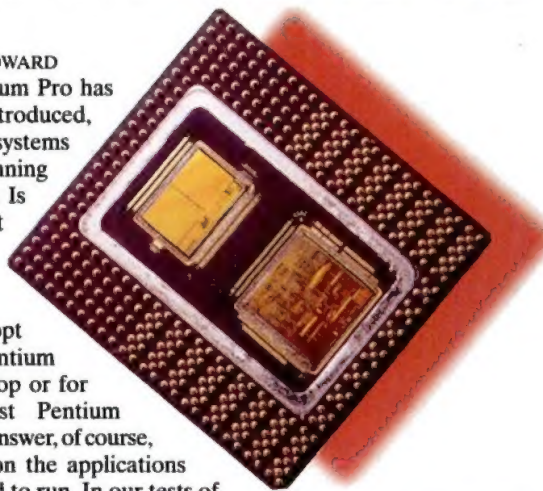
COVER STORY

Pentium PCs

Two Paths to Power

BY BILL HOWARD

The Pentium Pro has been introduced, and new systems are beginning to appear. Is your best defense against obsolescence to opt for a Pentium Pro desktop or for the fastest Pentium PC? The answer, of course, depends on the applications you intend to run. In our tests of [11 Pentium Pro workstations and 31 166-MHz and 150-MHz Pentium systems](#), we put these machines through their paces to determine how your investment is best served.....100



Pentium Pro Workstations

The New Contenders



BY CAROL VENEZIA Is the newest necessarily the best for everyone? Can Pentium Pro units unseat RISC-based systems and become the workstation king? That's what we set out to discover with this roundup of 11 of the first 150-MHz Pentium Pro workstations103

150- and 166-MHz Pentium PCs

The Powers That Be

BY ROBERT S. ANTHONY As the new 150-

MHz and 166-MHz Pentium PCs shatter performance records, expect them to excel at what they do best: running basic business applications. This crop of [31 machines also raises the features bar](#): 6X CD-ROM drives are the norm, and 128-bit graphics cards come in as the undisputed performance leaders.....135



Pentium Pro Workstations:

Compaq Computer Corp.	112
Dell Computer Corp.	114
Digital Equipment Corp.	114
DirectWave Inc.	127
Hewlett-Packard Co.	127
IBM PC Co.	130
Micron Electronics Inc.	131
MITAC	131
NEC Technologies Inc.	131
Sys Technology Inc.	133
Zenith Data Systems	133
Highlights	103
Editors' Choice	108
The Next Step: 200-MHz	

Pentium Pro.....110

Price/Performance Index.....112

Performance Tests.....116

Summary of Features.....127

150- and 166-MHz Pentium PCs:

Acer America Corp.	138
Caliber Computer Corp.	143
CompuTrend Systems Inc.	150
Comtrade	150
Dell Computer Corp.	152
Digital Equipment Corp.	152
DTK Computer Inc.	153
EPS Technologies Inc.	153
Gateway 2000 Inc.	154
IBM PC Co.	155
Micron Electronics Inc.	156
Mitsuba Corp.	157
NEC Technologies Inc.	158
PerComp Microsystems Inc.	158
PowerSpec	158
Quantex Microsystems Inc.	163
Reason Technology Inc.	163
Robotech Inc.	164
Royal Computers Inc.	164
SAG Electronics	169
Sys Technology Inc.	169
USA Flex Inc.	169
US Computer Direct.	170
Vektron	173
Zenith Data Systems	173
Zenon Technology Inc.	173
Highlights	136
Editors' Choice	138
Price/Performance Index	140
Performance Tests	146
Summary of Features	153

Networking

Wireless LANs: Free to Roam



BY PADRAIC BOYLE

Wireless LAN systems let your users work where they wish. Recently, cutting loose from your network has become much easier. Where wireless LAN systems were once costly and limited in features, they are now delivering better performance than ever at dramatically lower prices. Still, with a maximum throughput of 1.4 Mbps, they aim to supplement—not replace—the existing wired networks. *PC Magazine* tests and compares nine wireless solutions for Ethernet networks175



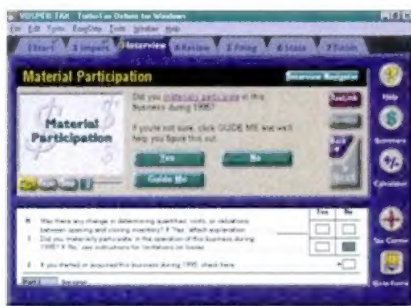
Aironet Airlan.....	181	Highlights.....	180
AT&T WaveLAN.....	182	Editors' Choice.....	181
BreezeCOM BreezeNET.....	186	Wireless Hardware	
<u>Digital RoamAbout.....</u>	<u>191</u>	<u>Finds a Niche.....</u>	<u>186</u>
IBM Wireless LAN Entry.....	192	How to Read the	
Proxim RangeLAN2.....	196	Suitability to Task Boxes.....	191
RDC PortLAN.....	200	Infrared Lights Up.....	194
Solocket Airlan.....	203	Performance Tests:	
Xircom Netwave.....	204	Wireless LANs.....	198
The Wireless Spectrum.....	176	Summary of Features.....	202

PC Magazine At Home

Taming the Tax Beast

BY KATHY YAKAL

April will be here before we know it, bringing not only spring showers but the inevitability of the tax deadline. This year, we look at the best and brightest tax preparation software packages that help you organize, simplify, and automate the arduous task of filing your tax return. We review four Windows products, highlight one OS/2 package and two DOS-only products, and provide some tips for finding tax help on the World Wide Web.....305



Kiplinger TaxCut.....	309	As Easy As . . .	314
Personal Tax Edge.....	321	Online Tax Info:	
<u>Simply Tax.....</u>	<u>322</u>	<u>Keeping Up with the IRS.....</u>	<u>316</u>
TurboTax Deluxe.....	330	DOS Tax Prep Products:	
The Best & Worst		Still Kicking.....	324
of Tax Prep Packages.....	308	Summary of Features.....	326
Editors' Choice.....	309	Tax Preparation for	
<u>Reading the Report Card.....</u>	<u>310</u>	<u>OS/2, Too.....</u>	<u>330</u>



PC TECH

Windows 3.1 Memory Enhancement Utilities

BY MATT PIETREK AND LARRY SELTZER

Five packages that claim to overcome a variety of memory limitations: Hurricane, MagnaRAM 2, QEMM 8, RAM Doubler, and SoftRAM 95.....205

Tutor

BY JEFF PROSISE The right tool for the job: Windows 95's Find command215

Power Programming*

BY JEFF PROSISE Status bars for your Windows 95 applications: A new standard control makes it easier to show users what they're doing218

Utilities*

BY RICHARD DRAGAN Warp Cabinet: An OS/2 file manager223

PC SOLUTIONS

User-to-User

BY NEIL J. RUBENKING Deleting all files before or after a specified date in Windows 95227

Hardware

Printing more than 99 copies using Windows 95's Direct Cable Connection; recurrent memory errors after a cold boot.....230

Operating Environments

Installing the OS/2 Warp FixPak 10; multiple operating systems without pain; a panacea for Windows 3.1 ailments234

Word Processing

Getting double-strike to work with Windows word processors.....244

Spreadsheets

A Lotus 1-2-3 template peculiarity: why the @IF is used with @SUM244

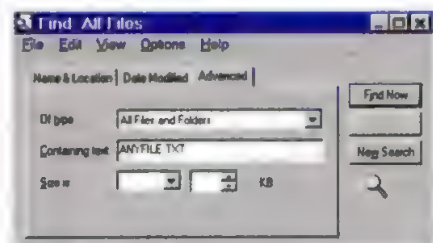
Databases*

Sending data directly to the printer in Paradox for Windows248

AFTER HOURS

Abort, Retry, Fail?

BY DON WILLMOTT.....338



The right tool: A great Find (page 215).

* Available on PC Online.

NETWORK EDITION

Follows page 96

Cover Story

Backup NT Servers

- ARCserve 2.01 for Windows NT, Enterprise Edition.....NE6
- Backup Director 4.0, Windows NT Edition.....NE12
- Backup Exec for Windows NT, Enterprise Edition 6.0.....NE18

First Looks

- Cogent EM110 T4 PCI adapter and S-1200 T4 Repeater.....NE43
- NetSuite Professional Design.....NE46
- BitSurf Pro.....NE47
- Xistor dd.400.....NE48
- CDexecutive 1.1.....NE49

New & Improved

BY ERYN BROWN AND ROBERT DALYNE51

Multiple Access

BY STEVE BUEHLER
TrustNo1.....NE55

ALSO IN THIS ISSUE

PC Direct	227
Marketplace	272
Premier	272
Classified.....	287
BusinessCard	301
Reader Service Card	279
Advertisers' Index: Companies.....	333
Advertisers' Index: Products.....	334
Coming Up.....	336
Editorial Product Index.....	337



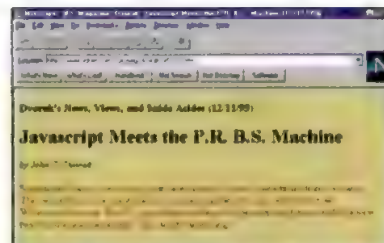
Gauging the truth (page 205).

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PC Magazine CD: Winter 1996 Issue

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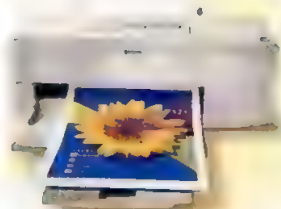
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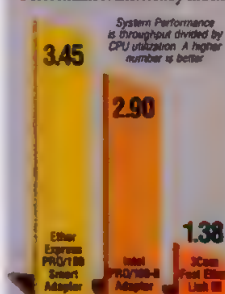
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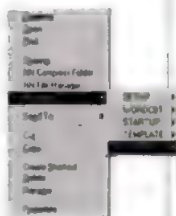
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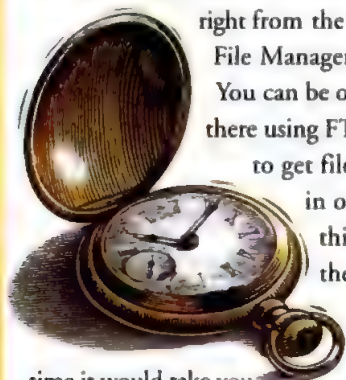
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PC Magazine, Editors' Choice, 11/21/95

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Letters

DIVINE INTROSPECTIONS

Bill Machrone's column "Divine Right and Divine Wrong" (November 7, 1995) really threw me for a loop. I was just about to order a Micron PC, largely on the basis of the reviews it received in your magazine, when I read about the memory problems Machrone has had with his machine. Now, I'm not so sure of my choice. Your story "A Pentium for Every Home" (May 16, 1995) spoke of putting the Micron P90 Home MPC and other Home PCs through a "torture" test, but if Micron is really the problem as Machrone's article suggests it is, how could your testing miss this? It's as if you've reported a crime without identifying the culprit, leaving me to find out whodunit in some future installment. It makes for entertaining reading in a murder mystery, but it's rather frustrating for someone who is about to lay out several thousand dollars on a PC for Christmas.

JIM ARRASMITH
San Jose, California

I read Bill Machrone's column, "Divine Right and Divine Wrong," with great interest. I have had similar experiences with a Zeos 486DX2/66 PC and a brand-new Micron P133, both running Windows for WorkGroups (WfWG). I turned to the Internet for help and found MOREMEM 4.0, a highly overpriced yet indispensable program that completely resolved the problem. But it is truly frustrating to pay \$40 for a mere utility to fix what is likely a Microsoft programming problem with WfWG. It is even more disheartening to hear that Windows 95 does nothing to resolve this situation. In his article Machrone writes "I don't have all the answers, but I'll get them." I look forward to your endeavors on our behalf.

JON H. PETERSON
via the Internet

Trouble with Windows 95 and you're surprised? I would have thought the flooded help lines when the product finally became available would have clued you in. From everything I have heard about Windows 95, I am going to stick with OS/2 Warp. I can multitask, and if a Windows application gives a GPF, all I have to do is restart the application.

DAVID D. BOURGOIN
via PC MagNet

I don't have any trouble running Windows 95 on one PC, but I do run into problems when trying to network it to another PC. It's too bad OS/2 is obviously dead, since it was never this finicky.

H. SAWADA
Montreal, Canada



*You're not the only
one struggling with
Windows 95*

Many of your columnists write about their latest and greatest hardware and the neatest new gizmos. But when Machrone complained that his Micron P90 with 32MB RAM and a 1GB hard drive couldn't run Windows 95, I had to raise an eyebrow. Then, when he mentioned his Dell P90 laptop, it hit me—technological karma. If you have more than your share of cutting-edge technology, then it follows you must also bear more than the average share of problems.

DAVID W. CRUZ
via the Internet

Machrone's column struck a familiar chord in me. I, too, was frustrated with messing with HIMEM, EMM386, and device-driver loading order, in vain attempts to squeeze out a few more kilobytes of conventional memory. After reading the prerelease technical descriptions of Windows 95 and realizing that low memory would still be a problem, I chose an option that Machrone does not mention: Windows NT. It runs slower than either WfWG or Windows 95 and you can't play some DOS games on it, but it always runs, and I have never found a limit on how many applications you can run.

RYLAN LUKE
via PC MagNet

Thanks for Machrone's column about memory problems with Windows 95. I, too, have a Micron P90 but have yet to upgrade to Windows 95. It seems that for the power user, Windows 95 is still lacking, and Windows NT may be the best choice.

RYAN M. RODGERS
via PC MagNet

I was amused by Machrone's column "Divine Right and Divine Wrong." I have personally installed Windows 95 on four different machines since its release and not without problems. But through perseverance, I was able to resolve what turned out to be hardware conflicts, not Windows 95 problems. I comfortably load five to six programs (including Microsoft Word and Excel) at boot-up and never look back. For me, Windows 95 has been a lifesaver.

TODD B. TAYLOR
via PC MagNet

ON FORM AND FUNCTION

In his column, "A Change in Direction" (October 24, 1995), John C. Dvorak makes an interesting observation concerning the similarities of the marketing of Windows 95 and the marketing of automobiles. But he makes a wrong turn when he implies that there is nothing significantly new in either Windows 95 or new model automobiles. I'm sorry, that's just not true. Mr. Dvorak also claims there have been no significant advances in autos since the automatic transmission and implies that the same lack of significant development is about to occur with software. I contend that there have been and will continue to be many significant advances in both the automobile and software industries.

TOM MORARRE
via PC MagNet

Contrary to Dvorak's opinion, the biggest single advance in auto design was the styling changes of the late thirties that put passengers and cargo between the axles rather than over them. This not only lowered the center of gravity and profile of passenger cars but made them aerodynamic. The offshoot of all this was the smoother ride, safe handling, and unitized body, which was a decided departure from riding high over the axles on what was essentially a truck chassis. Form does not necessarily follow function. Ergonomic design and styling can, in themselves, be functional changes or catalysts to a major design improvement.

BILL COPENHAVEN
Boise, Idaho

While conceptually elegant, John C. Dvorak makes the all-too-common mistake of painting with a wide brush. All engineers do not suffer from artistic insensibility. I am an engineer and consider myself reasonably literate and artistic. If I were to assume the equivalent position of Dvorak, I could state that all persons engaged in computers have eschewed people for machines and consider screen savers fine art.

RICHARD M. FRAUENGLASS
Huntington, NY

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Letters

John C. Dvorak was right on with his comment about incorporating the year into the product name. There is something wrong with the PC retail system and computer sales in general—they're too frantic. Wouldn't it be nice to purchase a computer and be satisfied that it will remain somewhat current for at least a year? Today, you're lucky if it remains current for a week.

DAVE THIRD
Toronto, Canada

LOOKING FOR A FIGHT

Jake Kirchner's column ("The Low Spark of High-Tech Competition," October 24, 1995) struck a nerve. If our new information/technology world is to encourage risk-takers to continue bringing innovative ideas to the market, society may need to re-examine its view of intellectual property rights. Successful ideas from small software developers tend to be quickly copied by the Big Blue and Big Bill market leaders.

KIP SCHOLL
via the Internet

In "The Low Spark of High-Tech Competition," Jake Kirchner claims that the energy of the PC software business has sputtered away. He cites Microsoft's dominance in the applications suite arena with Microsoft Office as the reason and laments that neither Lotus nor Novell/WordPerfect can truly compete in the word processor and spreadsheet markets. Well, I say that's wonderful, with apologies to Lotus and Novell/WordPerfect. Wishing that there could still be word processor and

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CORRECTIONS AND AMPLIFICATIONS

In "Display Mates" (October 24, 1995), we printed WinBench 96 and Winstone 96 results for both Windows 3.1 and Windows 95. Although our story text indicated that the benchmark results for Windows 95 were not a factor in overall product evaluation or Editors' Choice selection, the benchmark charts on page 327 should have noted the preliminary nature of the data. At the time of testing none of the graphics adapters included final versions of their Windows 95 drivers. In addition, several results appeared incorrectly: The Graphics Winmark 96 results for the Cardex Genesis/V Pro, Hercules Graphite Terminator Pro, and the Diamond Stealth64 Video 3200 should have been 17.8, 18.1, and 17.4 millions of pixels per second, respectively. The Winstone 96 results for Cardex, Hercules, and Diamond should have read 58.0, 58.1, and 55.4, respectively. We also neglected to include the Hercules Internet address, <http://www.hercules.com>, in our features table.

Our PC Magazine utility ZipView (December 19, 1995) inadvertently used the name of a completely different DOS shareware utility, ZipView 1.24, by Jerry Kwit. Mr. Kwit has kindly allowed us to retain the ZipView moniker, calling our utility ZipView for Windows 95. Mr. Kwit's DOS utility is available by contacting jeeryk@cpcug.org or by writing to him at 4506 Little River Run Dr., Annandale, VA 22003.

spreadsheet competition is like looking for competition among multiple incompatible databases, longing for a fight between macro assemblers, or cheering on a market split among three different operating systems. Those battles have been mostly won. Let's move on to fighting new wars.

MIKE SCHINKEL
via PC MagNet

I'm writing regarding the Trends article "Microsoft Maps Internet Roads" (October 24, 1995). That Microsoft intends to control the Web should not come as a surprise to any long-time watchers of the industry, or to savvy internet users. Let the Web be transformed into a worldwide shopping mall with Microsoft pulling the strings; we're only a step away from that already. To tell the truth, if I had to choose between the government and Microsoft controlling the World Wide Web, I would choose the latter.

WILLIAM J. ORTIZ
via PC MagNet

STAYING IN FOCUS

Jim Seymour should be congratulated on "Your Eyes Come First" (October 24, 1995). For years I've noted that whenever a monitor's image is below a certain threshold of sharpness, my eyes go in and out of focus. Where has everyone else been on this critical topic?

FRED PULVER
via the internet

As a computer programmer I really appreciated Seymour's column. I think it highlighted an important issue for anybody who sits in front of a computer all day.

TOM HAMMELL
via the Internet

Mr. Seymour, I'm afraid you've been sold on a lot of hype. Eyestrain is not "dangerous." You can wear any type of glasses you want and still not damage your eyes, though you may be a bit uncomfortable and not see very well. All screens have some degree of

optical haze, and it is this that attracts our attention, causing a momentary shift of focus and blurring. People with eye symptoms should see their eye care professional, they should clean their computer screens, but they do not need to search for amber and green text in a magic box. Thank you in advance for any additional business your column may generate, but I'd prefer you had your facts straight.

DAN EISENBERG, MD
via PC MagNet

ONE STEP AT A TIME

In his recent effort to compare the PowerPC and Pentium processors ("PowerPC: A Work In Progress," October 24, 1995), Jim Seymour is quick to condemn the PowerPC for its moderate performance when running today's software. It appears that, as in the early days of the operating-system wars, too much emphasis is being placed on how well a superior architecture supports the applications of the present or the past. I doubt that people will be interested in buying a PowerPC in the hopes that they can run Microsoft Office just a little quicker, but they may buy one to make use of heavy graphics and video. Let's move on. Intel's x86 architecture will run out of steam. The PowerPC has room to grow.

MARK GURRY
via PC Mag Net

DEMYSTIFYING WINDOWS 95

As a long-time PC user new to Windows 95 and still on the steep part of the learning curve, I found Barry Simon's article, "Windows 95 Shell Game" ("Inside Windows 95," October 10, 1995) very useful. But I could not follow some of the more cryptic instructions describing the Dynamic Control Panel setup. I know that this process can be done using the Win-Hacker shareware utility, but I'd rather learn how to do it myself. That's why I buy PC Magazine. I think the article assumes a little too much knowledge on the part of some readers.

DAVID NICHOLLS
Canberra, Australia

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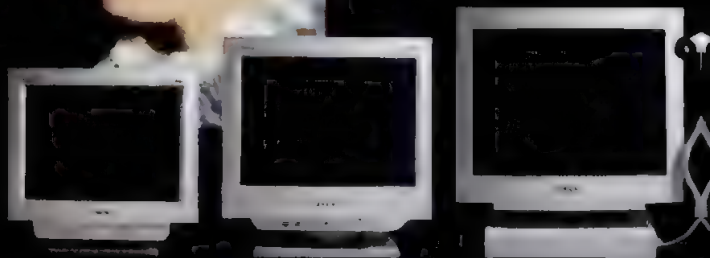
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CIRCLE 201 ON READER SERVICE CARD



Cyber Censors

It almost seemed inevitable. Here comes the news we have all been expecting ever since "Sex on the Internet" became a hot topic. The government has issued an edict banning access to certain sexually explicit newsgroups, and one of the leading providers

has gone along with the decree. It's exactly what the crusaders against so-called cyberporn have fought for, and exactly what advocates of free speech have feared.

The only surprise: It wasn't the U.S. government but the German government. Yet it had the same impact. CompuServe, the giant U.S.-based online service, cut off worldwide access to 200 sex-related newsgroups, reportedly because it was ordered to by the German government. After a huge number of complaints from customers, CompuServe later said it was working on a technological solution that would block access to its German subscribers but would restore service to the rest of the world.

It's only a matter of time until the same thing happens somewhere in this country. Congress has already agreed to wording that would hold service providers responsible for "indecent" material, though this is part of the huge telecommunications reform bill that has yet to be finished.

While the uproar about pornography is overblown, there certainly are newsgroups and other sites that post material I think is objectionable and really not appropriate for minors. So I support the efforts of many of those sites, and many Internet providers, to restrict access. On the other hand, I think the language in the current telecommunications bill banning "indecentcy" is too broad, too ambiguous, and quite possibly unconstitutional. I don't think there's any need for new legislation at all, but if anything has to be adopted, I much prefer the language in a proposal by Representative Rick White, which focuses on parental control and restricting access to material "harmful to minors" but prohibits the FCC from regulating online content.

Still, I'd rather see the restrictions apply to the creators of the content rather than the service that merely provides access. And even in that case, I'd rather see the industry come up with voluntary guidelines and technological solutions that make information designed for adults available only to adults. Of course, sexual content remains only a small portion of what's out on the Internet. It gets most of the attention because it incites people, gives politicians



FREEDOM ONLINE

The language in the telecom bill is too broad, too ambiguous, and possibly unconstitutional.

something to talk about, and sells papers. But, in the long run, this is about free speech in its most basic form.

While I'm very concerned about proposals to limit access to information and sites in the U. S., at least we have First Amendment rights to free speech. So, in fact, does Germany. But what about a country without those freedoms? Let's say one of those countries decides to ban access to *The New York Times*, for example, because it covered a dissident movement? Do access providers go along with it in that country? Or worldwide?

That's why I think some sort of technological answer, like the one CompuServe eventually proposed, is inevitable. The simplest way to get around the country restriction is for subscribers in one country to call a provider or an access point in another country. If that gets blocked, there are other options ranging from simple encryption to current schemes to break a message into tiny parts that must be reassembled by the user. It all sounds a lot like *Mad Magazine's* "Spy vs. Spy," but it probably will satisfy most of the governmental demands for restrictions.

Of course, it will also make life more difficult for users and global service providers. Providers will probably need to work with governments around the world, and they will have to tailor their services to the individual markets. They want to appeal to people who are family-oriented and thus may well make it harder to access some sites that are inappropriate for minors. This leaves room for smaller Internet providers that don't have to worry about international restrictions or family audiences.

We all have to accept that information—online or anywhere else—can be dangerous, whether it is about sex, politics, or weapons. As a result, governments will try to regulate it. That's part of their job. To some extent, they are bound to fail, because this genie is out of the bottle. I'm convinced that anyone who really wants to get information will be able to, though it may become harder. And we're bound to get into more international disputes about information policy for one basic reason: Bits and bytes don't care about international boundaries. □



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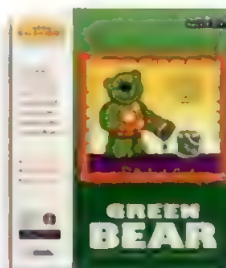
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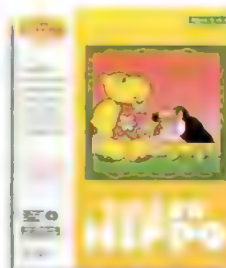
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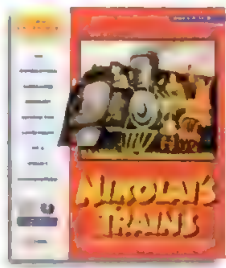
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Trends

TRENDS & TECHNOLOGIES SHAPING THE PERSONAL COMPUTER MARKET

The Plug-In Parade

Will Netscape's tools rule the Web?

In the race to control the tools and enhancements for developing snazzy, multimedia-capable World Wide Web sites, Netscape Communications is getting more ambitious. Netscape's Inline Plug-Ins are the latest tools that developers are using to produce "active" content—that is, rich, interactive content that lets you do much more than just read static Web pages. Plug-Ins will let you listen to background music as you visit a site, fire up real-time video, or explore a 3-D world directly from the Netscape Navigator browser.

Providing the tools for creating this rich, active content is an important part of Netscape's strategy to remain the platform of choice for the Web. Sun's Java Web-development language is also designed to deliver such content, and Microsoft has announced its intention to license Java, so Netscape is not without competition.

Plug-In support will be available in the upcoming Navigator 2.0, but players are already lining up with Plug-Ins you can download today. And with the release of Shockwave from Macromedia, which plays Director files within Netscape, Plug-Ins are starting to grab attention.

To activate a Plug-In, Netscape Navigator monitors network data and identifies the type of data contained in the Plug-In. The data could be an Acrobat file, for instance, or a video file from VDOLive, or an audio file from RealAudio. Navigator then

creates what's called an "instance" of the Plug-In object to handle the particular data type.

The current software development kit creates three kinds of Plug-Ins: ones that are embedded within HTML pages, ones that are full-screen, and ones that are hidden. Shockwave is an embedded Plug-In that displays its contents initially as a rectangular object on a page. Click on the object and the content becomes live. Check out Disney's *Toy Story* promotion site (<http://www.toystory.com/toybox/shock.htm>) for a great example of a Netscape Plug-In in action.—Rick Ayre

The Web at 15 FPS

Video on the Web gets prepped for prime time.

It may be time to take Web-based video seriously, now that several developers are determined to perfect the technology. Santa Clara-based VDOnet Corp. (<http://www.vdolive.com>) recently announced that VDO-Live is compatible with the Netscape 2.0 Web browser via Netscape's Plug-Ins. VDO Live

plays video clips from any Web page designed to use it at 15 frames per second over a 28.8-Kbps modem.

The technology is not precisely "real-time," in that the VDO-Live player requires a brief wait as it fills its buffer, after which it

plays directly from the VDO-Live server. Transmission slows to one to two frames per second with a 14.4-Kbps modem.

According to VDOnet, several variables can hurt video quality, including "traffic over the Internet, traffic on the VDOLive server, and network overhead on your local- or wide-area network."

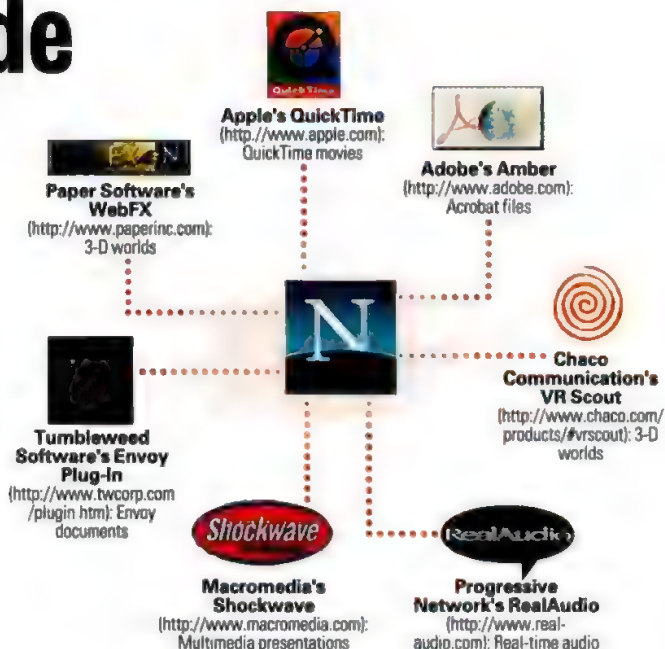
The most common problems with video transmissions from the VDO-Live server are blurry displays, low frame rates, and random noise resulting from lost audio packets when bandwidth is slow.

What kinds of new applications will be ushered in as real-

time video becomes viable on the Web? Progressive Network's RealAudio, which plays real-time audio on the Web, has been a hit already with electronic-magazine publishers and news-delivery sites. VDOnet's CEO, Asaf Mohr, foresees similar "desktop video broadcasting" applications using VDOLive as well as video-based advertising on the Web.

Other Web-based video solutions are Net Toob from Duplex Software, and StreamWorks from Xing Technology. CompuServe and Xing are now working together to take live audio and video-streaming online.

Meanwhile, the Internet Engineering Task Force recently demonstrated a protocol for facilitating multimedia content on the Web, called Resource Reservation Protocol (RSVP), which the group expects to adopt this year.—Sebastian Rupley





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Web Terminals Take Shape

But at rock-bottom prices, can they ever be profitable?

Oracle's CEO, Larry Ellison, is a big backer of Web terminals, or "hollow PCs"—devices without hard disks, floppy disks, CD-ROM drives, or super-fast processors. While the idea has prompted much industry skepticism, several developers are betting on their success.

ViewCall America, an Atlanta-based start-up, promises to deliver an Internet terminal priced under \$300. The set-top box, which is dubbed WEBster, is embedded with Netscape Navigator and connects to a TV and to a phone line via a 28.8-Kbps modem. With a nod to a new generation of couch potatoes, WEBster will include a wireless remote-control unit with special Web-browsing functions.

For a small monthly fee, the ViewCall service will point subscribers to Web-based malls and banks sponsored by ViewCall America. WEBster won't be sold

at retail stores, but it will be distributed through a partnership with Northern Telecom. The device may even sell for less than the cost of its manufacture, in an effort to spur lucrative Internet service-provision revenues.

Apple Computer CEO Michael Spindler also has his sights set on the Net-terminal battle. With the company's sub-\$1,000 Pippin system, you'll be able to browse the Web using your TV and a handheld controller. Toy maker Bandai plans to market the device in Japan first, with U.S. distribution around midyear.

Britain's Acorn Computer Group P.L.C. is building Net terminals as well. Its A-7000 Net-surfer is a sub-\$900 multimedia PC with a fast modem and stripped-down hard disk that will use a TV set instead of a monitor. The company plans to release a \$500 version early this year.



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- 3 **Print Shop Deluxe CD Ensemble** Broderbund
- 4 **Microsoft Publisher** Microsoft
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- 7 **Print Shop Deluxe** Broderbund
- 8 **Automap Streets** Microsoft
- 9 **Automap Road** Microsoft
- 10 **Street Atlas USA** DeLorme

Source: PC Data. Data for November. Additional lists are available at <http://www.zdnet.com/~pcmag/topten>.

Few product demonstrations have been as eagerly awaited as Ellison's promised "network computer"—a sub-\$500 device with 4MB of DRAM, 4MB of flash RAM, an infrared connection to a keyboard, a connection to a color monitor or TV, a network connection, an ARM microprocessor, and a software-upgradable ATM chip.

But cost could turn out to be a major issue. A key bottleneck, say naysayers, is the display technology. Quality displays are expensive, and many industry ana-

lysts doubt whether a TV can display sharp Web-based text.

It may turn out that the successful Web terminal is actually a repositioning of existing low-end hardware. Sun Microsystems' Scott McNealy has talked about Web- and Java-enabled personal digital assistants. Sony's Magic-Link PDA and Apple's Newton both have new Web-browsing capabilities. And Compaq Computer has talked about "disposable PCs" that will run Windows 95, a Web browser, and little else.—*Sebastian Rupley*

Don't Tell Candice Bergen

Call Sri Lanka or Helsinki for a buck an hour.

The Internet is doing all kinds of business behind the backs of the phone companies. Not only does VocalTec's Internet Phone let you make long-distance calls while bypassing long-distance rates, but RADLinX's fledgling PassaFax PF-1 will now send faxes over the Internet and allow you to forsake AT&T, MCI, Sprint, and other phone services. Both are fantastic ways to skirt the system now, but they may force extensive government regulation of the Internet in the future.

PassaFax is a new \$950 hard-back-size converter that connects standard facsimile devices to an Ethernet LAN and allows you to send faxes over the Internet and over internal corporate

networks running TCP/IP. During a transmission, two PassaFax units create a direct connection between remote sites for immediate confirmation of fax retrieval. Multiple fax machines can share a unit, and there's also an option for sending faxes over the public phone lines.

If you're already paying for direct access to the Internet, then your interoffice fax traffic—whether it's local, national, or international—can now be completely free. All you need is a converter at each sending and receiving location. "According to a Gallup/Pitney Bowes poll," says

RADLinX spokesperson Ilene Wiener, "the average Fortune 500 company spends \$5.4 to \$7.2 million a year on fax transmissions, and 55 percent of those transmissions are destined for branch offices." Should PassaFax



be widely implemented, the battling long-distance phone companies will surely become lighter in the pockets.

VocalTec's \$49.95 Internet

Phone (<http://www.vocaltec.com>) uses a vastly different approach, but the monetary end result is the same. When coupled with your PC's sound features, it allows for real-time, full-duplex conversations with other Internet Phone users around the globe. Since you're paying only for an Internet access account and a local call to your access provider, a call to Sri Lanka or Helsinki can cost as little as \$1 per hour.

In an era when almost nothing comes for free, such products are sure to force changes in Internet regulation or in the ways that products are allowed to operate. So get in as many Internet faxes and phone calls as you can before you're charged for every byte that you send into cyberspace.—*Cade Metz*

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HEY, EVERYONE CAN USE A LITTLE HELP.

Fault-Tolerant Notebook Screens Under Development

Thin CRTs may reduce factory throwaways.

Manufacturing flat-panel displays for notebooks is a delicate and costly undertaking. Since one or two bum pixels can ruin an otherwise perfectly good display, the number of throwaways on the factory floor is high, and the expense associated with low manufacturing yields is passed on to notebook buyers.

Silicon Video Corp., an aggressively backed venture with funding from Compaq, Hewlett-Packard, and other investors, has developed a new kind of notebook screen that's designed to be more tolerant of defects than a conventional LCD display. A cross between a desktop cathode ray tube (CRT) and a flat-panel LCD, Silicon Video's Thin CRT uses a compact layer of electron emitters behind each pixel in-

stead of an electron gun lodged inside a bulky glass tube.

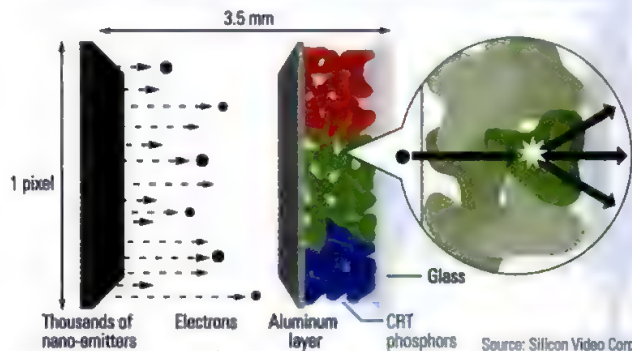
The technology's potential lies in its clever use of built-in redundancy. Only 70 percent of the several hundred electron emitters located behind each pixel are needed to activate the pixel; thirty percent of the emitters can be defective and the pixel will still work.

While Thin CRTs could eventually offer a cost advantage derived from volume manufacturing, don't expect the cost of notebooks to free-fall anytime soon. Silicon Video, based in San Jose, has some formidable manufacturing challenges of its own to beat, including the production of delicate ceramic spacers to prevent the glass from warping.

The viewing area on the current prototype is only 2.4 inches; sam-

How a Thin CRT Display Works

In a Thin CRT display, each pixel is powered by thousands of nano-emitters. Thirty percent of them can be defective, but the pixel will still work.



Source: Silicon Video Corp.

ples of a 12-inch display should be ready in late 1997 or early 1998. In the meantime, Silicon Video is developing the manufacturing infrastructure to handle the high-vol-

ume production of Thin CRTs. And that's no simple task. The company has raised \$95 million in financing so far, but it needs \$205 million more.—Carol Levin

PC Magazine Online Events



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Fast Video to Go

Speedier notebook graphics.

If you've considered turning your notebook PC into a full-time desktop replacement but rejected the idea because of the graphics performance penalty you'd have to endure, it may be time to reconsider your options. This spring, notebooks are expected to say so long to 32-bit graphics chips and catch up to desktop performance, which has moved to 64-bit chips and beyond.

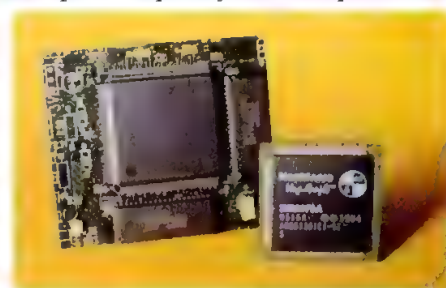
Silicon Valley semiconductor start-up NeoMagic has designed a notebook chip that crunches graphics calculations in 128-bit chunks. While the traditional way to pump up

graphics speed packs more memory chips on the motherboard, NeoMagic has rethought the basic design and sucked all the graphics memory into the chip.

By integrating graphics memory rather than accessing memory chips externally as notebooks do today, the chip has the bandwidth to breeze through such heavy-duty multimedia tasks as soft-

ware-based MPEG decoding. "The biggest return is in multimedia functionality of 30 frame-per-second video," says NeoMagic's marketing vice president Niall Bartlett.

NeoMagic has also proved some industry watchers wrong. As its NM2070 Flat Panel Graphics Accelerator rolls out, NeoMagic will have proven that its chip design is indeed production-worthy. It demonstrated the concept last year, but skeptics doubt-



BANDWIDTH BABY: NeoMagic's integrated graphics chip (right) breaks with conventional design.

ed the company could produce the chip in quantity.

While the benefits of integrating memory and logic on a single chip are well known, the challenge is to keep it cost effective, says Geoffrey Ballew, an industry analyst at Dataquest. "NeoMagic has a good technology for making this cost effective," he says.—*Carol Levin*

By Jake Kirchner

Learning to Dance with the Elephants

I'm getting a kick out of reading all the news articles on Microsoft's desperate scramble for survival in an Internet age. It's not that I enjoy the thought that the software leader might actually be driven out of business by Netscape, Sun Microsystems, and the other Mambo kings of the moment.

My vicarious thrill rather is in the about-face of the pundits who just weeks before were warning about Microsoft's supposed master plan to take over the online world through its Microsoft Network and the Web-browsing technology in Windows 95.

Microsoft in a fierce struggle for survival? Please!

If you want to find a company struggling for survival, consider one of the companies whose daily fight for existence is like that of a mouse caught in a herd of sleepwalking elephants. Consider one of the companies whose market has been flattened by the lumbering giant, Redmond. Consider, for example, Software Publishing Corp.

It has been a tough couple of years at SPC, whose Harvard Graphics presentation package—a one-time industry leader—has since been superceded by the suite-based presentation products, with Microsoft's PowerPoint now the market leader by a wide margin.

SPC was faced with the growing realization that no matter how many new features it might add to Harvard Graphics, it would never take market share back from PowerPoint. And so SPC commissioned a market survey that confirmed what everyone else in the industry already knew: Most people pick a suite for the word processor, the remainder for the spreadsheet it contains.

In effect, most users of presentation software have to live with



SPC's grim conclusion is that the market for new Harvard Graphics buyers has all but evaporated.

the product that comes along with their suite and consider it more or less a free application thrown into the mix. So why should they pay extra for Harvard Graphics? SPC's grim conclusion was that the market for new Harvard Graphics buyers has all but evaporated.

In response, SPC decided to continue upgrading and supporting Harvard Graphics for its installed base of 1-million-plus legacy users, but it has given up any effort to supplant PowerPoint. Instead, the company is moving into new markets—seeking a safe place to do business far from the stampeding elephants.

Based on technology SPC acquired from several Go Corp. refugees who founded Digital Paper, SPC is bringing out a series of new products, which a company executive said will offer a different approach from the suite-based mega-apps that Microsoft offers. The trick, he said, is to "keep it simple and keep it focused." The first product in the line is the acclaimed ASAP, a bare-bones presentation package that, though small and simple to use, is slick and fast. It produces presentations impressive enough to win converts among those who find PowerPoint and Freelance just too complex, massive, and daunting.

With a Windows 95 version due out around the time you read this and a version integrating ASAP into Microsoft Office right behind, SPC is making good on its promise to learn to dance with the elephants. For the sake of the diversity that we need in the computer industry, we can only hope that more of those struggling to compete with Microsoft prove half so nimble.

Ergonomic Design Hits the Road

Innovative keyboards for the human body.

While keyboards for desktop PCs come in a variety of shapes and sizes, including those engineered specifically for multimedia, ergonomics, or integration, notebook keyboards have been locked into an 11- by 4-inch format. Starting with last year's innovative Butterfly fold-out keyboard from IBM (a *PC Magazine* Technical Excellence Award winner last year), designers finally appear ready to check their preconceived notions at the door.

Samsung is the latest notebook manufacturer to rethink the design of portable keyboards.

While IBM's Butterfly keyboard, which is on its ThinkPad 701c, is designed to fit a full-size keyboard into a subnotebook,



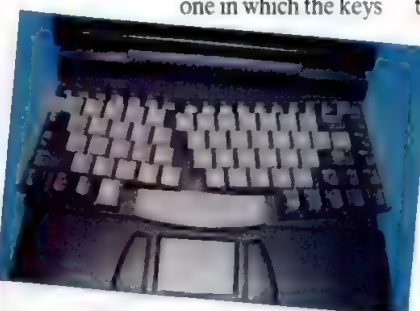
the split keyboard in Samsung's upcoming SENS810 notebook is designed for comfort.

Contained in the same space as a standard notebook keyboard, the Samsung design lets you choose a standard rectilinear keyboard (the photo on the left) or one in which the keys

are split into two sections that pivot: Each section swings out for a more ergonomic design (the photo on the right). Or you can adjust the angle of the keyboard to a position that's anywhere between standard and fully extended.

Like its desktop counterparts, the split keyboard is intended to reduce the stress on the outer part of the hand that can result from typing on a traditional keyboard. And like the newest desktop keyboards, the Samsung ergonomic keyboard includes the three Windows 95-specific keys; the keys are full-size 19-millimeter pitch.

Samsung expects to ship the SENS810 notebook in the first quarter of 1996.—Brian Nadel



FLIPPED OUT: Samsung's new ergonomic keyboard on the SENS810 splits into two sections to ease stress on your hands.

*I trade pork bellies
and soybean futures
in my boxers.*

With my new Acer® Aspire™ Desktop, I can take Aspire. To Do More.
on Wall Street from home. Aspire has Windows® 95
and a powerful Intel® Pentium® processor,* so I
can explore complex "what if"
trading scenarios. With its voice-
activation capability, I can get
into my financial programs
without typing. The fax modem and full-duplex
speakerphone help me cut deals over the phone

or online. And with built-in voice mail, I never
A few more things
miss a call. I can even calculate my net worth or
I can do with my Aspire:
improve my golf swing, because Aspire includes
Order out for pizza.

50 preloaded software and reference titles. Plus,
Manage my own portfolio.
the quad-speed CD-ROM¹ drive and AuraSound™
Design an addition to my home.

3-D stereo speakers are terrific for multimedia.
Lower my handicap.

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ACE, the Acer Computer Explorer, helps me
And make my own plane reservations.
navigate around it with ease. With Aspire, it's
easy to keep control of my finances and my life.



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¹Specifications vary by model and configuration. Not all models/colors available at all retail locations. Specifications subject to change without notice. See your local retailer for more information. *Acer Aspire Desktop models 2120, 2121, 2710, 2711, 2720, 2721, 2920 and 2921 contain Intel Pentium processors.



*For the location of the Acer Aspire dealer nearest you,
call 1-800-529-ACER. Or visit us on the World Wide Web
at <http://www.acer.com/aac/>*

First Looks

HANDS-ON REVIEWS OF NEW SHIPPING PRODUCTS

WINDOWS 95 UTILITIES

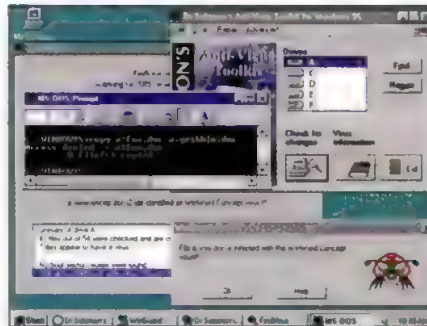
Windows 95 Antivirus Utilities: The Latest in PC Protection

By Neil J. Rubenking

As Windows 95 replaces DOS and Windows 3.1 as the operating system of choice, many systems can be left vulnerable to virus attack. That's because there is no antivirus utility supplied with Windows 95.

By one count there are 6,000 new computer viral strains each year, and most are more insidious than the familiar Stoned or Anti.EXE viruses.

We compiled a selection of five currently available Windows 95 antivirus products: Dr. Solomon's Anti-Virus Toolkit for Windows 95 (\$125), from S&S Software International; Norton AntiVirus for Windows 95 (\$79.95), from Symantec; PC-cillin 95, Version 1.0 (\$49.95), from TouchStone Software Corp.; ThunderByte Anti-Virus Utilities Professional Version for Windows 95 (\$149.95), from ThunderByte TCT International Corp.; and VirusScan for Windows 95 (\$65), from McAfee



CAUGHT IN THE ACT: Dr. Solomon's Anti-Virus Toolkit stops an attempt to copy a file containing the WinWord.Concept virus.

programs are a mix of old and new: Each relies primarily on scanning files for signatures of known viruses, and each uses

Associates. We found that each provided at least a minimum level of protection, and each had its strengths and weaknesses.

As a whole, these antivirus

a Windows 95 virtual device driver (VxD) for background processing. Each can scan disks upon access, scan files at start-up, scan programs before execution, and

even scan files when they're copied or otherwise accessed.

In addition, each can scan DOS-based programs that load before Windows 95, and each supports some form of DOS-based recovery, in case a virus disables Windows 95. By the time you read this, all five will all be able to detect macro viruses, such as WinWord.Concept.

Scanning for known virus signatures is only as good as your database of viruses. All five products provide updates to signature files via BBS, Internet, or mailed-disk subscription. PC-cillin and ThunderByte Anti-Virus go a step further and include software to download updates automatically. Annual disk-subscription prices vary widely, from Dr. Solomon's Anti-Virus Toolkit's included first year of updates (each additional year costs \$225) to Norton AntiVirus's and

Continues on page 40

PORTABLE PCs

Canon's NoteJet IIIcx Packs an Office into a Briefcase, Barely

By Brian Nadel

The latest in a long line of all-in-one portable PCs, the Canon NoteJet IIIcx tries to be all things to all people. The \$7,498 NoteJet IIIcx provides all the computing power you'd want on the road, and it doubles as a color printer, monochrome scanner, and fax machine.

By nature a generalist that covers a lot of computing territory, the NoteJet IIIcx's output falls short in comparison with the results you'd get with individual pieces of hardware but makes up the difference with superb integration. In view of everything that it does, the NoteJet IIIcx is a technological marvel that will appeal to those on the go who need many of the accouterments of a modern office or to

frequent travelers who are tired of paying hotel fax charges.

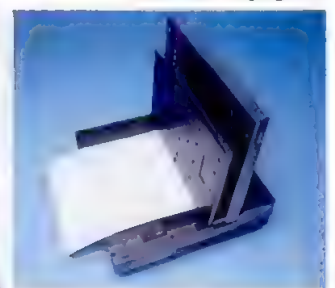
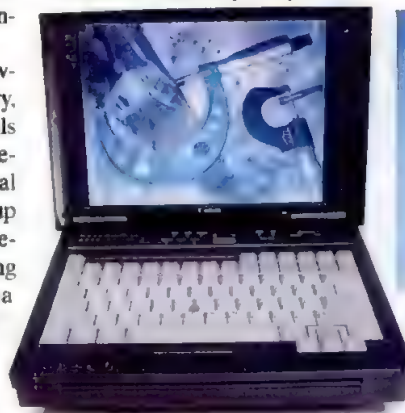
HOT AND HEAVY

The first thing that you'll notice about the NoteJet IIIcx is its size. Measuring 2.6 by 10.2 by 12.3 inches, it is a behemoth by today's note-

book standards. At a travel weight of 10 pounds 15 ounces, the NoteJet IIIcx is a lot to haul, and at times it stretched the handle on our notebook bag. The system and its oversize power adapter weigh 9 pounds 10 ounces and 1 pound 5 ounces, respectively.

And with all that it has under the hood, the NoteJet IIIcx can run hot. Floppy disks often come out warm and the bottom of the unit can make your legs sweat.

Continues on page 43



HEAVY LOAD: Canon's NoteJet IIIcx is the heavyweight of the notebook business, but it includes a built-in printer and scanner (inset).

IN FIRST LOOKS

CommEx 1.20.....	44
FrontPage 1.0.....	44
SmartSuite 96 Edition for Windows 95.....	48
HP DeskJet 340.....	51
PSA Cards 2.61.....	51
Informer 1.5.....	54
Internet Explorer 2.0.....	54
MountainGate IncreMeg full profile Docking Station.....	56
NEC MultiSpin 4x4.....	56
AirCommunicator Lite.....	60
AuthorSoft 3.1.....	63
Print House for Windows 95.....	63
PlanMaker 2.....	66
PowerDesk.....	66
AKS BassPump.....	69
ClickBook 2.0.....	69
Wise Installation System 4.0.....	69

First Looks

Antivirus Utilities

Continued from page 39

ThunderByte Anti-Virus's \$99.95 cost. In between are PC-cillin's \$9.95 and VirusScan's \$69.95 yearly fee.

Three of the programs go a step beyond signature tracking with behavior monitoring, which can detect viruses by their effect on the system rather than by file pattern. Norton AntiVirus, PC-cillin, and ThunderByte Anti-Virus store integrity-checking data about executable files and use the information to raise warning flags when even the slightest file modifications are made.

In addition, Norton AntiVirus, PC-cillin, and VirusScan carry the National Computer Security Association (NCSA) logo, which means they have been certified to detect all of the viruses in the NCSA collection. The others, Dr. Solomon's Anti-Virus Toolkit and ThunderByte Anti-Virus, claim to be able to detect all of the viruses in the organization's collection—and more.

We gave these first five Windows 95 virus scanners a workout, testing them with an array of powerful viruses. We set each product to scan all executable files on our 90-MHz Pentium PC's 800MB hard disk, and to scan compressed files where possible.

Each program was adept at detecting the viruses we used, but we found that ThunderByte Anti-Virus and PC-cillin were the fastest to scan the hard disk, at 41 seconds and 53 seconds, respectively. We also timed how long a product took to scan a floppy disk that contained 60 files. Again, ThunderByte Anti-Virus and PC-cillin were the fastest, at 7 seconds and 11 seconds, respectively.

These five programs offer something for everyone: From Norton AntiVirus's flexible approach to PC-cillin's automatic in-

tervention to ThunderByte Anti-Virus's speed to VirusScan's thorough Windows 95 integration to Dr. Solomon's Anti-Virus Toolkit's ability to detect macro viruses.

DR. SOLOMON'S ANTI-VIRUS TOOLKIT FOR WINDOWS 95

Dr. Solomon's Anti-Virus Toolkit for Windows 95 is a mixed bag: The virus-fighting code is fully Windows 95-aware, but its user interface doesn't make the most of the Windows 95 environment. It was also the only program of the five reviewed here that wasn't Windows 95-certified.

For example, the program's background modules are simply minimized rather than housed in the system tray, there's no Windows 95 uninstall support, and context menus, property sheets, and drag-and-drop support are absent.

Dr. Solomon's Anti-Virus Toolkit (along with PC-cillin and VirusScan) can search for viruses hidden when an infected program is compressed with PKLITE or a similar utility. It also searches files multiply archived in formats, including .ZIP, .ARC, and .LHA.

The program includes a protective macro for Word for Windows that warns you when a document is infected with a macro virus. Power users can use Dr. Solomon's Anti-Virus Toolkit's viewers to peek directly at boot sectors or into suspected files.

One minor flaw is that Dr. Solomon's Anti-Virus Toolkit's virus-alert pop-up window can't be seen when a full-screen DOS box is running. The system is still protected, but the user will see only an "Access Denied" message. The alert pop-up is visible as soon as the user switches out of the full-screen DOS box.

At 1 minute 31 seconds to scan our hard disk, the program tied with VirusScan as the slowest virus scanner but was closer to the aver-

age on checking floppy disks. All in all, Dr. Solomon's Anti-Virus Toolkit prefers to straddle Windows 95 and Windows 3.1 rather than fully embrace the new operating system.

Dr. Solomon's Anti-Virus Toolkit for Windows 95

List price: \$125 (includes four quarterly updates). Requires: 4MB RAM, 10MB hard disk space, Microsoft Windows 95. S&S Software International Inc., Burlington, MA; 800-701-9648, 617-273-7400; <http://www.dr Solomon.com>. Circle 435 on reader service card.

NORTON ANTI-VIRUS FOR WINDOWS 95

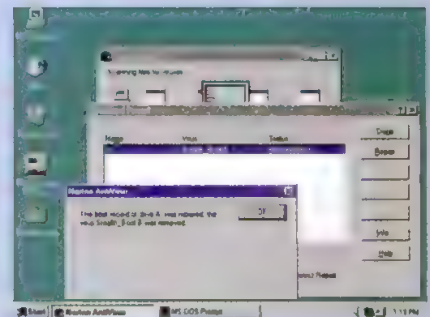
A thoroughly modern program, Norton AntiVirus for Windows 95 installs easily and goes right to work. Its Auto-Protect and Scheduler modules use the Windows 95 Taskbar, and at any time you can drag a suspect file onto the scanner for a quick checkup.

A promised update early this year should let Norton AntiVirus detect macro viruses within Windows 95. Norton AntiVirus currently detects macro viruses by using the DOS-based scanner.

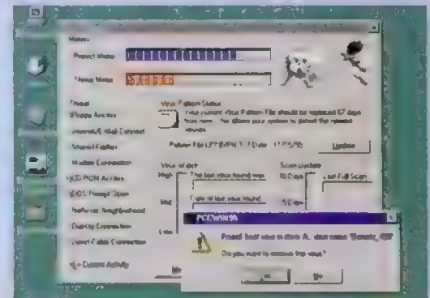
A host of option settings lets the user control just about every aspect of scanning, including the frequency of scanning, the file types to be scanned, and the response when a virus is discovered. Norton AntiVirus alerts come through loud and clear, even in a full-screen DOS box. And Norton AntiVirus's Virus Sensor technology allows it to detect unknown viruses by simulating execution in a completely separate—and protected—memory space.

Norton AntiVirus will not detect a virus in a compressed program file if the virus was present before compression. It will, how-

Side by Side: Windows 95 Antivirus Programs



READY AND WAITING: Norton AntiVirus's Background and Scheduler modules reside in the system tray on the Taskbar.



DOS PROTECTION: PC-cillin 95 prevents a virus from sneaking into the system during a DOS DISKCOPY operation.

ever, detect viruses that reside inside an archive, such as a .ZIP file.

Norton AntiVirus was able to check our hard disk for viruses in 1 minute 19 seconds, which was about average. On the whole, Norton AntiVirus delivers a fully up-to-date method for ferreting out viruses.

Norton AntiVirus for Windows 95. Estimated street price: \$79.95. Requires: 4MB RAM, 12MB hard disk space, Microsoft Windows 95. Symantec Inc., Cupertino, CA; 800-441-7234, 503-334-6054; <http://www.symantec.com>. Circle 436 on reader service card.

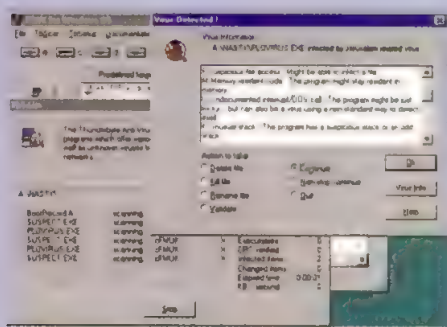
PC-CILLIN 95 1.0

TouchStone's PC-cillin 95, Version 1.0, is designed to make virus protection as simple and automatic as possible. Once installed, it decides where and when to scan based on the degree of threat: Using floppy disks or CD-ROMs, or connecting to another

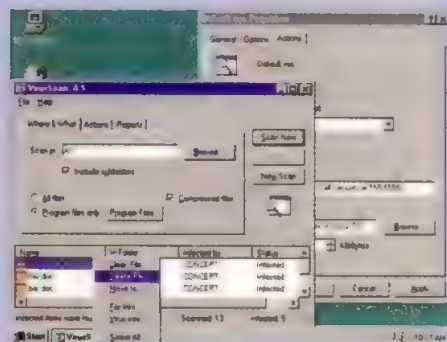


From February 12 to 16, go online to discuss Windows 95 antivirus products with representatives for each reviewed product and Neil J. Rubenking, contributing technical editor of PC Magazine. Type GO EXEC at any CompuServe! prompt.

First Looks



ALARM SOUNDED: ThunderByte Anti-Virus Utilities detects a virus and shows which heuristic flags were triggered.



BRIGHT FACE: VirusScan makes good use of Windows 95 interface elements, such as property sheets and context menus.

gram automates the actual update process as well. Press a button and PC-cillin downloads new virus signatures.

To trap unknown viruses, its VICE (Virus Instructional Code Emulator) technology scans program code for virus-related instructions and also monitors for viruslike actions by a running program. If a virus is detected, the Clean Wizard walks you through its cleanup and broadcasts an e-mail message to warn your correspondents, checks all accessible disks for infection, and checks disks you regularly use.

PC-cillin was second only to ThunderByte Anti-Virus in terms of scanning speed; it

Word for Windows macro virus.

ThunderByte Anti-Virus is known for its innovative heuristic viral analysis ("Windows 95 Utilities: Picking Up the Pieces," November 21, 1995). To detect unknown viruses, it analyzes program code by simulating execution and looking for suspicious, viruslike activities, such as going memory-resident, attempting to distinguish .COM from .EXE files, and a program's directly accessing the system's hard disk.

Simulated execution is useful in dealing with an encrypted virus, which must decrypt its own instructions before executing them. This forces such a virus to expose itself to the antivirus program. A file with sufficient suspicious activities will be flagged.

ThunderByte Anti-Virus is unusual in that it doesn't attempt to remove viruses from within Windows but rather works through DOS. If a virus is found, it offers to rename the file, delete the file, or delete the file with no possibility of undeletion. To remove the virus, you must boot the system from a clean DOS disk and use the supplied DOS version of ThunderByte Anti-Virus.

This two-pronged approach lets known viruses be eradicated using known methods. The DOS-based ThunderByte Anti-Virus has other options for cleaning unknown viruses. For example, it can simulate the virus's execution to make the virus repair the file, because every successful virus must make the host program seem to be functioning normally. Another option is file repair using information stored before the infection, including file size, a checksum, and several kilobytes of stored code from the beginning of the program.

The fastest of the five tested programs, ThunderByte Anti-Virus was able to scan our hard disk in 41 seconds, about twice as fast as the others. All in all, ThunderByte Anti-Virus is a very speedy and advanced first line of defense against virus attack.

ThunderByte Anti-Virus Utilities Professional Version for Windows 95. List price: \$149.95. Requires: 4MB RAM, 2MB hard disk

space, Microsoft Windows 95. ThunderByte TCT International Corp., Massena, NY; 800-667-8228, 613-930-4444; <http://www.thunderbyte.com>. *Circle 438 on reader service card.*

VIRUSSCAN FOR WINDOWS 95

Longtime users of McAfee's VirusScan may not recognize this version because it has been so well integrated into Windows 95.

There are context-sensitive menus for files, drives, and directories, as well as a properties page for .VSC (VirusScan Configuration) files that includes an additional page for defining what action to take when a virus is discovered. Right-click on a file identified as infected and you get a context menu that includes options to clean, delete, or move the file.

VirusScan detects macro viruses and installs protection directly in Word for Windows. The scanner relies on the System Agent, available in the Windows 95 Plus! Pack, for scheduled scanning; setup is a simple matter of creating a .VSC file and defining the desired scan options.

Numerous option settings allow customization: You can set the scanner to try to clean infected files automatically or delete them automatically; VirusScan's report will let you know which files were deleted, permitting you to restore them from a clean backup.

McAfee takes virus scanning to the Internet by offering WebScan, a \$65 program that examines downloaded files and e-mail in an isolated holding pen. A free evaluation copy, which includes Mosaic and the Pegasus e-mail client, can be downloaded from the company's World Wide Web site.

VirusScan took 1 minute 36 seconds to scan our hard disk, the slowest time of the group; its floppy disk scan time was the slowest as well.

VirusScan for Windows 95. List price: \$65. Requires: 4MB RAM, 10MB hard disk space, Microsoft Windows 3.1 or Windows 95. McAfee Associates Inc., Santa Clara, CA; 800-332-9966, 408-988-3832; <http://www.mcafee.com>. *Circle 439 on reader service card.*

computer via network or modem, all raise the threat level. After a virus is found, PC-cillin goes into a high-intensity Virus Watch mode for 90 days.

PC-cillin checks for viruses in places that most scanners don't. For example, it scans files within archives such as .ZIP files and even compressed files within .ZIP files. It also scans uu-encoded attachments to e-mail messages.

PC-cillin can protect against infected downloads by scanning serial data as it arrives at your PC, before it makes its way to your hard disk. Other vendors argue, however, that there's no point in scanning for viruses until the data becomes a file on-disk, or until the attachment is uu-encoded into a file. But if you're concerned about getting a virus through the Internet, this feature may calm your nerves.

Another reassuring feature is PC-cillin's countdown to the next recommended update. The pro-

gram was able to scan our hard disk in 53 seconds. If you're looking for a way to react quickly and automatically to a variety of virus threats, look no further than PC-cillin 95.

PC-cillin 95, Version 1.0. List price: \$49.95. Requires: 2.5MB RAM, 4MB hard disk space, Microsoft Windows 3.1 or Windows 95. TouchStone Software Corp., Huntington Beach, CA; 800-531-0450; <http://www.antivirus.com>. *Circle 437 on reader service card.*

THUNDERBYTE ANTI-VIRUS UTILITIES PROFESSIONAL VERSION FOR WINDOWS 95

ThunderByte Anti-Virus Utilities Professional Version for Windows 95 was the fastest of the five programs we reviewed and in some respects the most thorough. By default, ThunderByte Anti-Virus scans Word for Windows .DOC (document) and .DOT (template) files, so there's no need to search every file to trap a

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after eating.**

You walk under ladders.

**You use a butter knife to remove
toast from the toaster.**

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client/server design at an IBM
Open Systems Center.**

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First Looks

Canon NoteJet IIIcx

Continued from page 39

The essence of the unit becomes apparent when you pop a four-color ink cartridge into the built-in, 360-dot-per-inch color printer. The printer is based on the engine from the Canon BJC-70 and was able to produce a page with 10 percent coverage in 49 seconds; a page with 45 percent coverage took 2 minutes 6 seconds.

Business graphics, such as pie charts and graphs, looked better than photographic images, which can suffer from severe banding and dark areas that are sometimes rendered as prominent black rectangles. Characters consistently printed clearly at the rate of 2.9 pages per minute. If you're going to do a lot of text-only printing, Canon offers a black ink cartridge that reduces the per-page costs.

QUICK-CHANGE ARTIST

The NoteJet IIIcx changes its persona quickly. Snap out the ink cartridge, install the optical-scanner module, run the setup software and perform a white-balance calibration, and the NoteJet IIIcx is transformed into a monochrome scanner with 64 levels of gray-scale and 360-dpi output.

Again, quality and speed lagged compared with dedicated hardware, but the NoteJet IIIcx's scanner does an adequate job of scanning text or line art. Curiously, the system doesn't come with an optical character recognition program for converting faxes to editable text.

On artwork, banding and aliasing were pronounced. And the unit was slow, requiring 1 minute 50 seconds to scan a *PC Magazine*

zine cover and 4 minutes 4 seconds to transfer that 11MB file. Once your document is scanned, the Twain driver can place it into any Windows application, which makes faxing documents easy; of course, you'll need a fax modem.

Getting acquainted with the NoteJet IIIcx is easy, thanks to Canon's excellent documentation and online guides. For example, the delicate process of changing

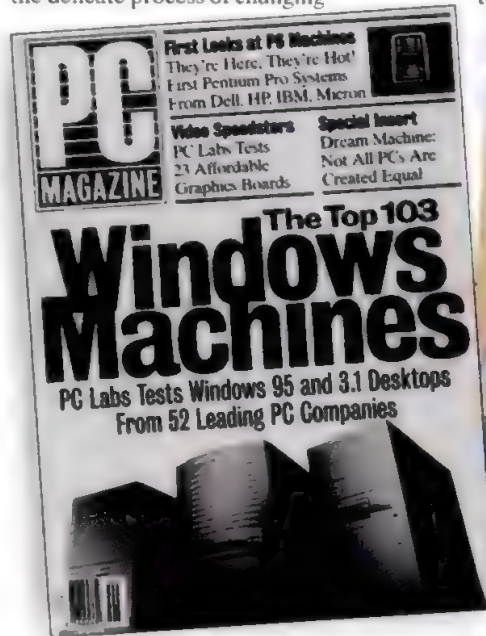
Mark 96 score was subpar. Despite this, images displayed on the system's 11.8-inch active-matrix screen were consistently bright, clear, and sharp.

Based on Duracell's latest Smart Battery technology, the NoteJet IIIcx's nickel hydride cells lasted for 1 hour 50 minutes on our WinDrain test with power conservation disabled. If you plan to print or scan, ex-

offer an internal CD-ROM drive for the NoteJet IIIcx.

AGAINST THE GRAIN

Details marred an otherwise impressive design. The keyboard frequently flexes while typing and the keys offer little in the way of tactile feedback. In addition, the system's plastic case bends when pressed in certain important places, which hardly inspires the sort of confidence



BAND ON THE RUN: Scans of text and line art worked well, but complex artwork (left image) resulted in banding and aliasing problems. The NoteJet IIIcx's 360-dpi color printer tended to produce muted colors (right image).

ink scanner cartridges is demonstrated with step-by-step photos that you can view while you work.

An average performer on the whole, the NoteJet IIIcx we tested came with a Pentium/90 CPU, 16MB of RAM, 256K of external cache, and an 810MB hard disk. The unit's best scores were on the 16- and 32-bit processor benchmark tests, where it surpassed the average by a comfortable margin. On the other hand, its 8-million-pixel-per-second Graphics Win-

mark 96 score was subpar. Despite this, images displayed on the system's 11.8-inch active-matrix screen were consistently bright, clear, and sharp.

The NoteJet IIIcx is chock-full of unexpected extras. There's an internal PCI bus and an IrDA infrared window, along with Puma Technology's versatile TranXit wireless-transfer software. Add in the included Sound Blaster audio card with built-in speakers and a microphone, as well as room for a pair of Type II PC Cards or one Type III PC Card, and you have a fully up-to-date portable PC. Canon does not

require of a portable PC. And though we're well into the era of the disappearing power adapter, the NoteJet IIIcx still relies on a 2.8- by 5.8- by 1.4-inch adapter with a three-prong outlet plug.

The biggest disappointment was the 10-page automatic sheet feeder for the printer and scanner. As with earlier NoteJets, we found that it was best to insert paper one sheet at a time.

Despite being large and heavy, the NoteJet IIIcx does so much that—as with the proverbial dog walking on its hind legs—the point isn't really how well it works but that it works at all.

Canon NoteJet IIIcx. Estimated street price: With Pentium/90 CPU, 16MB RAM, 256K external cache, 810MB hard disk, 11.8-inch active-matrix color display, \$7,498. Canon Computer Systems Inc., Costa Mesa, CA; 800-848-4123, 714-438-3000; fax, 714-438-3317. Circle 427 on reader service card.

BENCHMARK TESTS



Canon NoteJet IIIcx

On the whole, the NoteJet IIIcx was a solid performer, and its Winstone 96 score was just short of the average for a Pentium/90-based notebook. The unit excelled on 16- and

32-bit processor tests, posting scores that were significantly better than those of the average Pentium/90 system, its battery lasted less than 2 hours on our WinDrain test. We tested with Winstone 96, WinBench 96, and WinDrain. The system had 16MB of RAM

Higher scores represent better performance

	Winstone 96	Graphics WinMark 96 (Mpixels/sec)	Disk WinMark 96	CPUmark ₁₆	CPUmark ₃₂	WinDrain (hours:minutes)
Canon NoteJet IIIcx	38	8.0	588	160	182	1:50
Average Pentium/90 notebook (January 23, 1996)	39	9.5	545	152	147	1:40

INTERNET TOOLS

FrontPage: Desktop Publishing for the Web

By Luisa Simone

FrontPage 1.0, from Vermeer Technologies, provides a suite of program modules that both streamline and automate creating and maintaining a site on the Internet's World Wide Web. Simply stated, this \$695 program makes Web-site publishing as easy as desktop publishing.

Nowhere is this more apparent than in the FrontPage Editor, where you create web pages in a WYSIWYG environment. For example, instead of grappling with obscure programming codes, you assign HTML (Hypertext Markup Language) formats by highlighting text and choosing a predefined style. Regardless of whether you type the text in directly or import it (via rich-text or ASCII formats), the text appears on your screen exactly as it will appear when accessed by a standard Web browser.

Creating hypertext links is equally straightforward: You start by highlighting a text phrase or drawing a hot spot over an image. Then use a self-explanatory dialog box to link the object to a previously defined bookmark within the current Web page. Connections can be made to video files stored within the page or to any Web location that you specify.

Even without programming skills, you can build interactivity into your Web page, thanks to FrontPage's form objects and form *bots* (FrontPage's shorthand for robots). Functional check boxes, push buttons, drop-down menus, and text boxes are supplied as objects that you simply insert into a Web page.

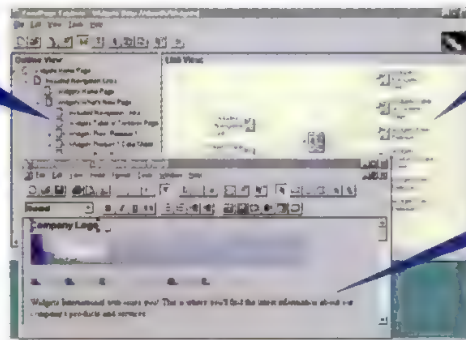
The behavior of these objects is controlled by one of a dozen predefined Common Gateway Interface (CGI) scripts. For example, you can use the Save Results *bot* to retrieve values from a field in a form. The *bot* then stores the information in a format you specify, such as HTML or ASCII.

Whereas the FrontPage Editor focuses on individual Web pages,

the FrontPage Explorer provides an overview of the entire Web. The Explorer lets you look at the Web with a hierarchical outline,

Other nice touches included in FrontPage are a to-do list, which helps keep track of tasks and multiple authors, conversion filters

The Outline view shows a traditional hierarchical file-tree diagram, which is editable.



The Link view shows a schematic drawing that includes all the links among Web pages.

The FrontPage Editor provides WYSIWYG tools for generating HTML text based on predetermined styles.

or a diagram of the links to and from a specified page.

The Explorer is basically a management module. You use it to add or delete pages; assign administrator, author, and user rights; verify the validity of the links; and copy a Web page from one server to another. FrontPage is a complete development tool. Novice users, for example, will be thrilled with the wizards that build personal Web pages, corporate-presence sites, or discussion sections based on your answers.

INSIDE OUT, OUTSIDE IN: The FrontPage Explorer shows your Web page from several perspectives.

that automatically translate standard graphics file formats (such as .PCX or TIFF) to the Web-standard .GIF or JPEG formats required by HTML, and the 16- or 32-bit Personal Web Servers that let you develop a Web site locally.

Making a commitment to FrontPage means that you must install the FrontPage Server ex-

tools and powerful functionality should make the decision to commit to FrontPage an easy one for both experienced and aspiring Web-site publishers.

FrontPage 1.0. List price: \$695. Requires: 8MB RAM, 16MB hard disk space, Microsoft Windows 3.1, Windows 95, or Windows NT, Winsock-compliant TCP/IP stack. Vermeer Technologies Inc., Cambridge, MA; 800-932-0075, 617-576-1700; <http://www.vermeer.com>. Circle 405 on reader service card.

UTILITIES

CommEx: File Management For the Windows 95 Era

By J. W. Olsen

Windows 95 users quickly appreciate the convenience of deleting, renaming, and copying files directly from their applications' Open, Save, and Save As dialog boxes. CommEx 1.20, from Cottonwood Software, offers these functions and more to Windows 3.1 users. So if you're biding your time with Windows 3.1, this \$15 utility is a useful file management update.

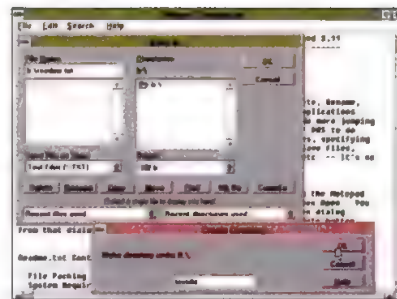
CommEx works by replacing Windows' Common Dialog .DLL with its own during setup. Thereafter, in the vast majority of applications (those that use COMM.DLG.DLL), Open, Save, and Save As are extended.

Without having to switch to File Manager or a DOS prompt, you can copy, move, rename, delete, and find files. You can also create, rename, and delete subdirectories, and when you highlight a file, its size, date, and time stamp are displayed.

CommEx has extended the standard Find feature to search across multiple directories and drives. All matching files appear in a scrolling box. When you see the one you want, you abort the search and select the file, which then appears in the Open or Save dialog box.

CommEx is one of those small delights that make life under Windows 3.1 just a little easier and more productive.

CommEx 1.20. List price: \$15. Requires: 4MB RAM, 1MB hard



FILE MAGIC: CommEx enhances the functionality of Windows 3.1's Open and Save dialog boxes.

disk space, Microsoft Windows 3.1 or later. Cottonwood Software, Leawood, KS; 913-663-3022; fax, 913-663-3747. Circle 406 on reader service card.

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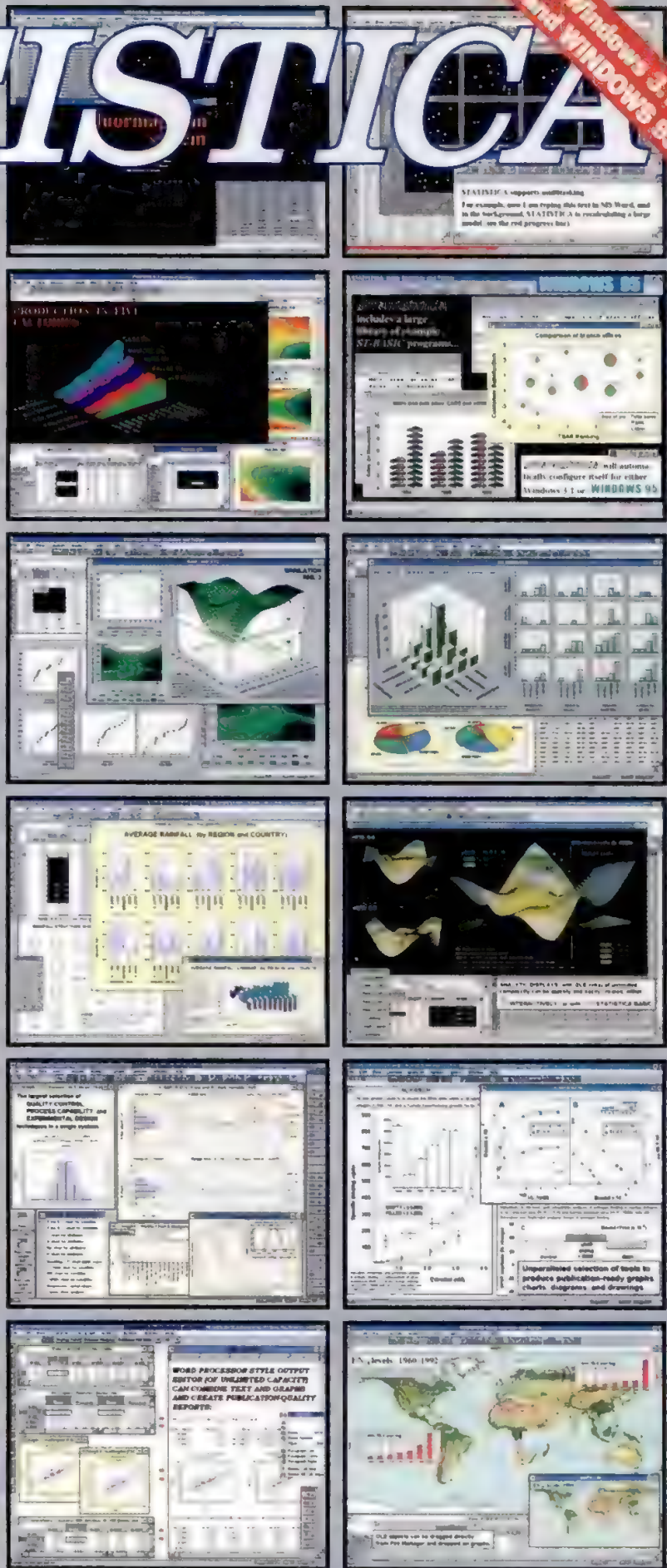
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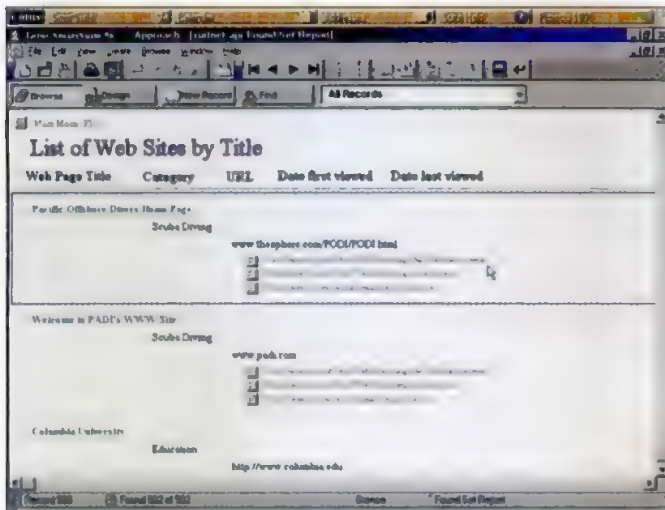
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SUITES

SmartSuite 96 Emphasizes the Workgroup and the Web

By Edward Mendelson

Everything in Lotus's SmartSuite 96 Edition for Windows 95 is designed to make it the application suite to choose for networked corporate computing. Compared with Microsoft Office 95, the \$399 SmartSuite 96 package offers tighter integration, a more advanced development platform, a more powerful control center than Microsoft's Shortcut Bar, unique workgroup collaboration features, and seamless connections with the Internet and Lotus Notes.

SmartSuite 96 includes 32-bit versions of the word processor Word Pro 96, the presentation-graphics program Freelance Graphics 96, and the database Approach 96, in addition to 16-bit versions of the spreadsheet 1-2-3 Release 5, the PIM Organizer 2.1, and the recording utility ScreenCam Windows. The older programs don't support long filenames.

The package includes a mail-in coupon good for 32-bit versions of 1-2-3 and Organizer, which should be ready later this year. Lotus promises OS/2 versions of the 32-bit applications later this year.

Whereas Microsoft has added a veneer of networking features

to Office 95, SmartSuite 96 is workgroup-oriented in every detail. Word Pro 96 and Freelance 96 include a TeamReview feature that lets a file's author specify which reviewers can make specific kinds of changes; it also attaches custom greetings. This feature in turn uses the TeamMail feature, which can store sets of routing options and destinations in reusable files and includes options to notify the original sender at each step or send copies of the modified document back to the sender as the document moves along. TeamMail works with Notes or any other MAPI- or VIM-based mail system.

Word Pro 96 is the only word processor that stores multiple versions of a document in the same file and consolidates revisions. SmartSuite 96's Internet support includes Word Pro 96's integrated World Wide Web browser and HTML (Hypertext Markup Language) template. Not only can you open and save files directly to Internet sites, but there's an icon that looks up the selected text in an online search engine. Freelance 96 can save a presentation as Web pages, complete with automatic links and an HTML contents page.

The programming language

WEB-AWARE: Approach 96 includes a sample database for storing World Wide Web sites, complete with one-click access to those sites.

LotusScript (not available for 16-bit 1-2-3) offers a powerful BASIC-like language for corporate automation. A NotesFlow feature lets developers customize menus in both the upcoming applications Notes 4 and SmartSuite 96.

Approach 96 retains its traditional ease of use but now supports LotusScript, includes named queries and sorts, and supports 32-bit .OCX (OLE Control) modules. Like Microsoft Visual Basic for Applications, which is currently available in Access and Excel, LotusScript requires programming experience, but most users should be able to record macros. In contrast, the PerfectScript used in Novell's PerfectOffice includes more end-user options.

To demonstrate its .OCX support, Approach 96 comes with a third-party Web-browser module, but the first release of the CD-ROM mistakenly shipped with a beta version that doesn't work on dial-up connections; you can find a revised version on Lotus's Web site.

SmartSuite 96's consistent interface uses menus that are less cluttered than those in Microsoft Office and Novell's PerfectOffice, but some functions are buried deep under layers of menus. The 32-bit applications use Lotus's InfoBox, a compact floating roll-up window with one-stop, dynamic control over the formatting of any text or object. Word Pro 96, Freelance 96, and Approach 96 use easily customizable SmartMaster templates for document creation, and Word Pro 96 lets you, with a few keystrokes, convert text into a "click here" block that can launch a macro, fill in a blank, or jump to an Internet site.

SmartCenter adds a narrow bar of customizable pull-down

"drawers" to the top or bottom of the screen. Included in the drawers are SmartSuite 96 shortcuts, an appointment calendar and address book, and a drawer of icons with links to help files and to Lotus and IBM sites on the Internet. Shortcuts can be added by dragging them from the Windows 95 Explorer or the desktop, but SmartSuite 96 isn't smart enough to open the original file if you drag the file's shortcut from a drawer to the application window. On our tests, SmartCenter sometimes crashed without being pushed very hard, and there's an almost complete lack of keyboard support.

Among the newly introduced 32-bit applications, Word Pro 96 is faster than its 16-bit sibling ("Word Processors: Front & Center," November 21, 1995) and comes with Lotus Chart, the powerful suite-wide charting module. Freelance 96 adds TeamShow, which lets you display a presentation over a network, with the speaker's notes visible only to the presenter.

SmartSuite 96 wants at least 57MB of your hard disk, and a complete installation fills 132MB.

The official 8MB requirement is only the starting point; we found that 16MB is more realistic. You'll also find that many components run slowly on anything less than a 90-MHz Pentium. Even on a 133-MHz machine, Word Pro 96 feels more sluggish than Word does, and Approach 96 loads painfully slowly, although its performance is often faster than that of Microsoft Access.

For computing on the enterprise scale, SmartSuite 96 is now the first choice.

SmartSuite 96 Edition for Windows 95. List price: \$399; upgrade, \$199. Requires: 8MB RAM, 57MB hard disk space, Microsoft Windows 95. Lotus Development Corp., Cambridge, MA; 800-343-5414, 617-577-8500; <http://www.lotus.com>. Circle 433 on reader service card.



From February 12 to 16, go online to discuss Lotus SmartSuite 96 with Lotus product executives and Edward Mendelson, a reviewer at PC Magazine. Type GO EXECONLINE on CompuServe.



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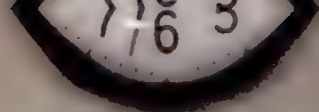
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- Gateway Information Highway CD
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G6-150

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- 256K Internal Cache
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G6-200

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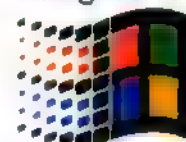
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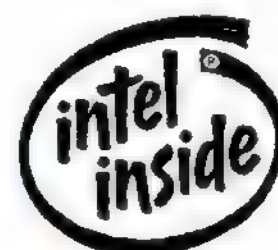
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INK JET PRINTERS

HP DeskJet 340: Better, But Still Far from Perfect

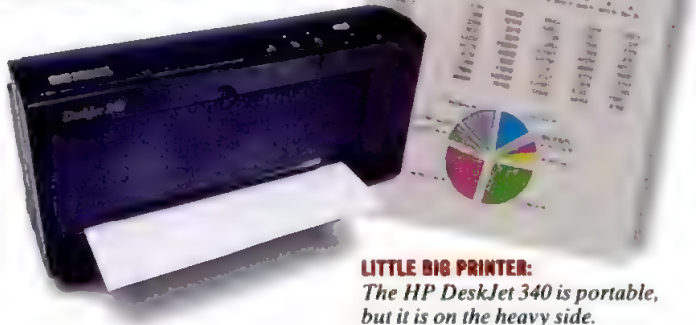
By Bruce Brown

Hewlett-Packard Co.'s DeskJet 300 series of printers have always been a little chunky as portable printers go, but DeskJet 500C compatibility and solid construction have been their strong points. The 600- by 300-dot-per-inch DeskJet 340, with a street price of \$299, adds a smaller standard sheet feeder, infrared interface support, and a higher-capacity ink cartridge. But it still doesn't print envelopes.

Weighing in at just under 6 pounds including the printer, sheet feeder, and AC adapter, the DeskJet 340 doesn't take up much desk space. But with dimensions of 2.5 by 12.2 by 6.8 inches, it's still a bit thick for packing in a briefcase. When you snap the standard 30-sheet portable paper feeder on the back of the printer, the depth increases by 1.2 inches. With either the portable sheet feeder or the \$99 optional 60-sheet desktop feeder, paper feeds in an L-shaped path from the rear. For thicker stock, there is a straight path for manually feeding paper.

A \$39 infrared accessory kit lets you print without a cable. The kit includes a small device that clips onto the parallel port and the JetEye infrared driver. To transmit print jobs, you position the printer within the line of sight of a portable or desktop computer with an infrared interface. According to the printer's documentation, the two devices must be within 39 inches of each other. On our tests, however, we found that a good signal connection was maintained up to approximately 10 feet.

The DeskJet 340 isn't a very fast printer. The printer is rated at 2 pages per minute (ppm), the same score it received on our Print Speed benchmark test. In comparison, the Canon BJC-70, a 3-pound portable printer and for-



LITTLE BIG PRINTER:

The HP DeskJet 340 is portable, but it is on the heavy side.

mer Editors' Choice recipient, produced nearly 4 ppm.

The new standard black cartridge is rated at 750 pages of 5 percent text coverage, yielding an average cost of 4 cents per page. A replacement cartridge costs \$27.95. The optional \$49 color kit includes a three-color

cartridge and a storage case that holds either color or black cartridges. The color cartridge, which costs \$34.95, is rated for 155 pages, resulting in a cost of 23 cents per page.

Black-and-white print quality is excellent, even on plain copy paper. The ink dries so quickly

that you shouldn't have any problem with smearing. Color print quality is typical of 300-dpi ink jet three-color printers, with medium saturation and color brightness. For typical business presentations and transparencies, the DeskJet 340 does a fine job in color and in black printing.

If you want to print away from AC power, a \$49 nickel cadmium battery is rated for approximately 100 pages of text per charge.

Rugged construction, improved paper handling, and infrared support make the HP DeskJet 340 better than ever, as long as you don't need to print on envelopes.

HP DeskJet 340. Estimated street price: \$299. Requires: 2MB RAM (4MB RAM for color printing), 10MB hard disk space, Microsoft Windows 3.1, DOS 3.3 or later. Hewlett-Packard Co., Palo Alto, CA; 800-752-0900; fax, 800-333-1917. *Circle 401 on reader service card.*

UTILITIES

PSA Cards: The Flexible Contact Manager

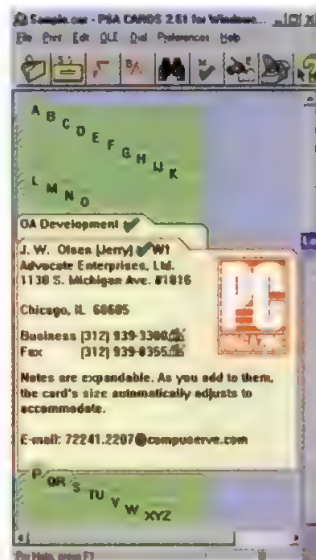
By J.W. Olsen

If Windows 95's or Windows NT's Cardfile just doesn't cut it but a full-featured contact manager such as Elan Software's GoldMine is overkill, PSA Software's \$25 PSA Cards 2.61 may be just what you're looking for.

PSA Cards' strength is its flexibility, which allows it to work like you do. For example, the program understands that you may want to access some records by corporations and others by individuals but list individual contacts within business records and corporate affiliations within individual records. Furthermore, you can assign related records to one or more groups.

PSA Cards is easy to use. Click on the "A" divider to access all records beginning with that letter. Then single-click on a record to display it or double-click on it to access a powerful, tabbed dialog box for editing it.

When auto-dialing, PSA Cards supports international and credit-card calls. Output options include



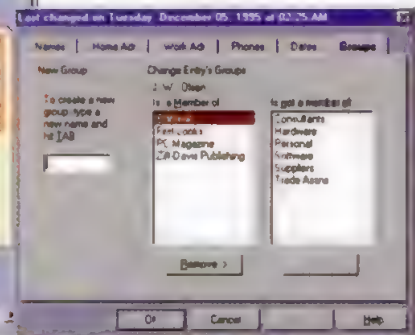
ALL TOGETHER: PSA Cards lets you assign records to multiple groups.

envelopes, rotary file cards, mailing labels, address books, and mail-merging, while import recognizes ASCII and Cardfile formats.

Although PSA Cards unfortunately doesn't support drag-and-drop, it serves as an OLE contain-

er for embedding or linking. There is also a notes field that expands to accommodate large entries. You may need to augment the product's sole e-mail address field.

PSA Cards provides an affordable, equitable balance between functionality and power.



PSA Cards 2.61. List price: \$25. Requires: 4MB RAM, 1MB hard disk space, Microsoft Windows 95 or Windows NT. PSA Software, Fort Collins, CO; 970-282-1298. *Circle 402 on reader service card.*

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Meridian 850 Notebook



Meridian 400 Subnotebook



Meridian 800 Notebook

Meridians with unretouched photo of active matrix displays.

Wherever you happen to go—the office, home, or a trip for business or pleasure—take along a ZEOS Meridian notebook. You get three exceptional systems to choose from. Each is a leader in its category, ready to give you the power, performance, and mobility that you could only dream of until now.

While each Meridian product is distinct, they all have several intelligent features that set them apart. All include local bus video; an 84-key keyboard with a comfortable palm rest and integrated TruePoint™ pointing device; and the most solid construction available.

Meridian 400 Subnotebook



"ZEOS is out to prove that good things do come in small packages with its Meridian 400C subnotebook," reported *Windows Magazine*.

At 3.9 pounds, the Meridian 400 is molded with a special carbon-fiber material that cuts weight and improves durability. And with a DX4-100MHz processor *standard*, it may well be the highest performance subnotebook available; "faster than a speeding desktop" is how *Computer Shopper* described it.

In addition to great performance, you also get hard drives to 350MB, RAM that's user-upgradable to 20MB, two Type II PCMCIA slots, an external ultra-light 3.5" 1.44MB floppy drive (included in Packages 2 and 3) and your choice of active matrix or dual scan color screens. Amazing!

Meridian 800 Notebook



"The 800A notebook offers sleek styling, solid construction and hot performance.... one of the fastest notebooks we've ever tested," said *Windows Magazine*.

At 6.3 pounds, the Meridian 800 full-size notebook is light enough to travel anywhere yet, with its whopping 9.5" active matrix color display, is large enough to use for presentations and everyday computing.

To complete the package, you also get a DX4-100MHz CPU, up to 20MB of user-upgradable RAM, a removable hard drive to 810MB, a built-in 3.5" 1.44MB floppy drive and PCMCIA slots supporting two Type II or one Type III devices. Full desktop features that fit in your briefcase!

Meridian 850 Notebook

"On our Graphics Winmark 95 tests... ZEOS's Meridian 850C grabbed the top position. The ZEOS 850C again finished first on our Disk Winmark 95 tests," reported *PC Magazine*.

Imagine, today's most advance computing capabilities wrapped up in a 6.8 pound package. With features including your choice of Pentium® processors, a 256K synchronous SRAM cache, user-upgradable memory to 32MB, removable hard drives to 1.3GB, PCMCIA support for two Type II or one Type III devices

and a built-in 3.5" 1.44MB floppy drive, this is the notebook computer that rivals today's most advanced desktops!

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No matter which Meridian notebook you purchase, you get the best service

and support in the business! ZEOS has won seven *PC Magazine* Readers' Choice for Service & Reliability awards. And, ZEOS was the first to provide 24-hour toll-free technical support.

With the ZEOS Meridian notebooks, you can go anywhere and be productive. Their performance, quality, reliability and durability make them a first-class travel companion. And it's easy for you to get on board. Just call your ZEOS Systems Consultant for a tour now at 800-554-7172. You won't want to miss it!

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➤ 4MB RAM ➤ 260MB IDE hard drive ➤ 800: Internal 3.5" 1.44MB floppy drive ➤ 400: 7.9" dual scan display; 800: 9.5" active matrix display ➤ MS-DOS 6.2 & Windows for Workgroups 3.11 ➤ MS Works			➤ 8MB RAM ➤ 350MB IDE hard drive ➤ 3.5" 1.44MB floppy drive. 400: External, 800: Internal ➤ 400: 7.9" dual scan display; 800: 9.5" active matrix display ➤ Custom nylon carrying case ➤ MS Windows® 95 or MS-DOS 6.2 & Windows for Workgroups 3.11 ➤ MS Works 95 or MS Works			➤ 8MB RAM ➤ IDE hard drive. 400: 350MB, 800: 528MB ➤ 3.5" 1.44MB floppy drive. 400: External, 800: Internal ➤ 400: 7.9" dual scan display; 800: 9.5" active matrix display ➤ 14.4 PCMCIA fax/modem ➤ Custom carrying case. 400: Leather, 800: Nylon ➤ Extra battery ➤ MS Windows 95 or MS-DOS 6.2 & Windows for Workgroups 3.11 ➤ MS Works 95 or MS Works		
Pentium® Processor	850C		Pentium® Processor	850C		Pentium® Processor	850C	
75MHz	\$2895		75MHz	\$3395		75MHz	\$3795	
90MHz	\$3095		90MHz	\$3595		90MHz	CNI \$3995	
➤ 8MB RAM, 256K synchronous SRAM cache ➤ 528MB IDE hard drive ➤ Internal 3.5" 1.44MB floppy drive ➤ 10.3" dual scan display ➤ Integrated 16-bit stereo sound ➤ MS Windows 95 or MS-DOS 6.2 & Windows for Workgroups 3.11 ➤ MS Works 95 or MS Works			➤ 16MB RAM, 256K synchronous SRAM cache ➤ 810MB IDE hard drive ➤ Internal 3.5" 1.44MB floppy drive ➤ 10.3" dual scan display ➤ Integrated 16-bit stereo sound ➤ Custom nylon carrying case ➤ Extra battery ➤ MS Windows 95 or MS-DOS 6.2 & Windows for Workgroups 3.11 ➤ MS Office Pro 95, or MS Office Pro			➤ 16MB RAM, 256K synchronous SRAM cache ➤ 1.3GB IDE hard drive ➤ Internal 3.5" 1.44MB floppy drive ➤ 10.3" dual scan display ➤ Integrated 16-bit stereo sound ➤ External amplified speakers ➤ 28.8 PCMCIA fax/modem ➤ Custom nylon carrying case ➤ Extra battery ➤ MS Windows 95 or MS-DOS 6.2 & Windows for Workgroups 3.11 ➤ MS Office Pro 95, or MS Office Pro		
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CIRCLE 151 ON READER SERVICE CARD

By J. W. Olsen

Setup couldn't be easier: Download MSIE20 .EXE from <http://www.microsoft.com/windows> or a major online service, then double-click its file icon. If you already have an Internet service provider, Internet Explorer configures itself accordingly. Otherwise, the installation wizard makes a connection via The Microsoft Network (MSN). Either way, you're online in minutes. We tested with

The key to Internet Explorer's charm is its integration into Windows 95. For example, when you right-click on a graphic, hypertext link, or blank area on a Web page, a context menu pops up that allows you to create a Shortcut on your desktop.

Internet Explorer offers one-click access to Internet newsgroups.



Internet Explorer supports the Secure Sockets Layer security standard and Internet Shopping tokens, which together promise secure financial transactions. The browser also has hooks for the new Microsoft/Visa Secure Transaction Technology (STT) and the proposed SSL Private Communications Technology (PCT) revision.

plug-in that is based on Inter-Vista's WorldView. We found it able to deliver animated 3-D graphics, though it was quite unstable. Microsoft is also working on versions of Internet Explorer that work in Windows 3.1, Windows NT, and Macintosh operating systems.

With its Windows 95 integration, security features, and effective use of multithreading, Internet Explorer 2.0 is a serious challenger to Netscape Navigator. **Microsoft Internet Explorer 2.0.** List price: Free download. Requires: 8MB RAM, 3MB hard disk space, Microsoft Windows 95. Microsoft Corp., Redmond, WA; 800-936-4200, 206-882-8080; fax, 206-936-7329. *Circle 409 on reader service card.*

SPREADSHEET ADD-ONS

By Craig Stinson

Informer uses the Excel PivotTable Wizard for specifying the field layout of a report. And once a report has been displayed, you can transpose its row, column, and

To help with presentations, Informer provides ten templates; any formatting changes you make via Informer's dialog boxes become part of a report's definition and are automatically reinstated when the report is executed.

Informer can be used with any ODBC data source supported by Excel. Excel 5.0 users building reports from large server-based tables will particularly appreciate Informer's performance enhancements. Reportech claims throughput gains over Excel 5.0 of up to 900 percent, depending on the size and complexity of the data source.

The screenshot shows the 'Customize' dialog box in Microsoft Word 2003. The 'Commands' tab is active. The 'Commands' list on the left is expanded to show 'Customize' and 'Customize...'. The 'Customize' command is selected. The 'Customize' list on the right is expanded to show 'Customize' and 'Customize...'. The 'Customize' command is selected. The 'Customize' list on the right is expanded to show 'Customize' and 'Customize...'. The 'Customize' command is selected.

Inform 1.5. List price: \$295. Requires: 8MB RAM, 8MB hard disk space, Microsoft Windows 95, Windows NT, or Windows 3.1. Reportech Inc., Bellevue, WA; 800-662-4317, 206-644-9646. *Circle 410 on reader service card.*

**For some people, it's enough to know that
MagnaRAM multiplies their computers' memory.
Others require a slightly more
detailed explanation.**



Dan Spear is a Quarterdeck Fellow and Senior Director of Advanced Research. He was the primary developer of QEMM, co-creator of the VCPI Specification, and holds two patents on memory management.

By Dan Spear

MagnaRAM — More Memory Without More Chips.

MagnaRAM is a utility for Windows[®] 95 and Windows 3.1 that gives you more usable memory. Using memory compression, MagnaRAM simply takes the physical memory on your system and stores more data in it. With MagnaRAM, you can run more and larger programs.

So how does MagnaRAM work? First, let me explain what memory compression and VxDs are all about.

Memory Compression?

If you have 1000 bytes of memory, how can you store more than 1000 bytes of information in it? MagnaRAM uses memory compression to pack up your data to fit into a smaller space.

Several programming techniques allow MagnaRAM to store data in less memory. One method involves noticing a repeating sequence of data, and storing the pattern instead of the data. For example, if you have 1000 bytes of data, all of which are the letter "A," you can represent them as (1000 A's), and save hundreds of bytes.

Open Up Windows With VxDs.

If you want to compress data stored in memory in Windows applications, you need a mechanism which is automatic and invisible — part of the operating system itself. Fortunately, Windows lets you add additional features to the operating system. How? By writing a driver called a VxD. One of the interesting

things a VxD can do is enhance another VxD by replacing its functions.

How MagnaRAM Lives Up To Its Name.

MagnaRAM enhances the VxD responsible for virtual memory, which effectively increases memory by temporarily using your hard disk as if it were more memory.

MagnaRAM reserves some physical memory for a compression buffer. It hooks into the service that is responsible for reading and writing data to your hard disk for virtual memory. When the operating system wants to write a page to disk, MagnaRAM copies the data into the compression buffer and tells the operating system that everything's O.K. Later, while the system is idle, MagnaRAM crawls through its buffer compressing the data. If the buffer gets filled up, MagnaRAM writes its compressed data to disk, so you write less to disk. When the operating system needs the data back again, MagnaRAM fetches it from either the buffer or the disk, decompresses it, and hands it back. This is invisible to the applications, the virtual memory system, and even the VxD that writes the data to disk.

This process allows more data to be stored in memory without going to disk because MagnaRAM has compressed the data to a fraction of its original size. Available Windows memory increases by a significant amount, even with the same amount of memory and disk space usage. Although MagnaRAM's compression and decompression do take time, they are typically faster than disk access. System performance can vary depending on the types of applications and the degree of compression that MagnaRAM can achieve.

MagnaRAM will give you more memory; I encourage you to visit your local retailer and try out the product for yourself. For more information, give us a call at 1-800-683-6696. Or go to our website at <http://www.quarterdeck.com>.



CD-ROM DRIVES

NEC's MultiSpin 4x4 Shuffles A Quartet of Disks

By Alfred Poor

NEC's new CD-ROM changer, the MultiSpin 4x4, is designed to make it easy and affordable for just about any Windows user to add a CD-ROM changer to their system. With a price of just \$279, it costs little more than a single quad-speed drive and frees the user from juggling disks.

The MultiSpin 4x4 is an enhanced IDE drive that fits in a standard half-height 5.25-inch-disk drive bay and comes with a low-profile ISA interface card, a demonstration video, and drivers for Windows 3.1 and Windows 95. The Windows 3.1 drivers let you choose either to have separate drive letters assigned to each CD slot or have all your disks assigned to one letter. The Windows 95 driver will only give each CD its own driver letter, though free updated drivers with an all-in-one drive letter will be available early in 1996, according to NEC.

Based on a four-disk Nakamichi CD-changer engine, the MultiSpin 4x4 doesn't use a caddy or a tray; press a button and the front hatch opens to reveal a slot. Slide a CD into the slot to add it to the drive; ejected CDs emerge from this opening.

Four buttons on the front panel let you control which slot is selected for inserting or ejecting a disk. The front panel also has a stereo headphone jack and a thumbwheel volume control.

On our tests, we found that the drive was easily capable of reaching quad-speed data-transfer rates. Using Microsoft's VidTest utility, we achieved a throughput of 609 kilobytes per second. It took about 8 seconds on the average to change disks from one slot to another and read a directory under DOS.

While the drive was easy to use and fast at moving data, there are

a few shortcomings. One is that under Windows 95, the driver appears to shuffle through each disk when starting some programs (such as Windows 95's CD Player), which can take up to 40 seconds. Another is that the documentation states that you can only play an audio CD in the first slot, but in fact CD Player will scan all the disks in the drive and



FOUR FOR ONE: NEC's MultiSpin 4x4 loads four CD-ROMs—one at a time.

will play the first one that contains audio CD tracks. If a disk has audio CD files on it, you can use

Windows 95's Explorer to launch CD Player and play audio tracks on that disk no matter which slot it is in. Finally, the drive had the annoying tendency to eject a disk occasionally during boot-up.

On balance, however, the ease of use and low price make the MultiSpin 4x4 a compelling alternative to a single-CD quad-speed drive for new PCs and system upgrades alike.

MultiSpin 4x4. Estimated street price: \$279. Requires: Free ISA slot or IDE connector. NEC Technologies Inc., Boxborough, MA; 800-632-4636, 508-264-8000; <http://www.nec.com>. Circle 407 on reader service card.

REMOVABLE STORAGE

IncreMeg Drives: Rock-Solid Portable Data, at a Cost

By Daniel Grotta and Sally Wiener Grotta

MountainGate's removable drive system, IncreMeg, is a rugged, reliable place to put key data that needs to travel from one PC to another. Designed primarily for high-volume uses, IncreMeg suffers from lack

The key to IncreMeg's ruggedness is that the hard disks are surrounded by high-impact, padded plastic shells that are designed and built to military specifications. The inside is coated with a silver nickel alloy to eliminate electromagnetic interference, and there are baffles in the front and rear for cooling.

The drives have accessible DIP switches for selecting parity, write-protect, and power-conservation settings.

MountainGate provides no utility capable of using the power-on/power-off feature, however.

Setting up and installing either the SCSI or IDE drive bays does not require any special knowledge. The external SCSI docking bay comes equipped with an auto-switching power supply, an on/off switch, a noisy fan, user-selectable ID buttons, a pair of 50-pin SCSI connectors, and several status lights.

Inserting and removing a drive cartridge isn't quite the same as swapping a floppy disk or SyQuest cartridge. IncreMeg uses a pull-out, push-in handle on the front to lock in and remove the drive. When the drive is in place, the system's REM light in-

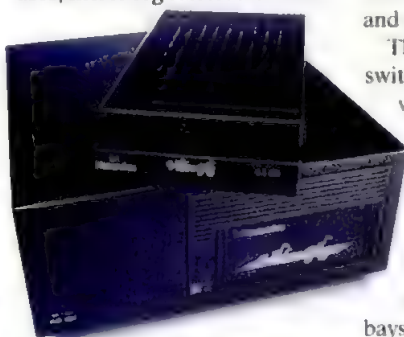
dicates when it's safe to power-down and remove the drive. Getting the drive to release can be difficult, though. There's nothing to prevent the user from removing a drive prematurely, which can result in lost data and possible damage to the drive.

Though IncreMeg doesn't come with any PC drivers or utilities, Adaptec's EZ-SCSI had no difficulty recognizing the drive. It took us less than half an hour to unpack, attach, partition, and format a 4.1GB Seagate Barracuda drive. Seagate's top-of-the-line Barracuda comes with a 1MB buffer and a rated seek time of 8 milliseconds, and it spins at 7,200 revolutions per minute (rpm).

On the whole, two items gave us pause: First, IncreMeg provides neither a physical lock nor software protection against simply pulling the drive out of its docking module. Second, at a total cost of \$2,970 for a 4.1GB hard disk, IncreMeg costs three times as much as typical data storage.

Cost and security considerations aside, we were impressed with the system's ruggedness and reliability.

IncreMeg full profile Docking Station. List price: \$665. **4.1GB drive cartridge.** List price: \$1,850. **2.0GB drive cartridge.** List price: \$1,500. Requires: 4MB RAM, Microsoft Windows 3.1 or later, SCSI controller. MountainGate, Reno, NV; 800-556-0222. Circle 408 on reader service card.



PORTABLE DATA: MountainGate's docking station and Seagate drives make data portable.

of security and high per-megabyte costs.

IncreMeg comes in a variety of sizes and configurations, from an internal single-drive docking bay to eight-drive, rack-mounted bays. Each bay can accommodate a variety of Micropolis, Seagate, or Quantum half-height and full-height drives, which are encased in plastic.



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*Some competitive upgrade offer applies to registered users of Microhelp Uninstaller, VeriSoft Remove-It, Landmark Uninstall-It, MS-Windows, and, of course, Quarterdeck CleanSweep. Dealer prices may vary.
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CIRCLE 388 ON READER SERVICE CARD

WIRELESS COMMUNICATION

AirCommunicator Makes the Connection, Wherever You Are

By Brian Nadel

Those who need to remain online regardless of where their job takes them will love the AirCommunicator Lite, a combination phone-modem, for its ability to use the nation's extensive cellular network. The \$550 handheld cellular flip-phone is unique in that it has a built-in 14.4-kilobit-per-second (Kbps) modem, easy-to-use software, and the ability to make a connection from a variety of locations.

By today's standards, the device's name, AirCommunicator Lite, is misleading. At 1.9 by 1.1 by 5.8 inches and 12 ounces, the AirCommunicator is twice as big and twice as heavy as Audiovox's cellular phone, the MVX600. But the AirCommunicator does much more than a standard cellular phone. It can transmit data and send and receive faxes, and it has an internal phone answering system that can hold nearly 3 minutes of voice messages.

DATA READY

Because it works off of the existing AMPS cellular-phone network—and not the emerging packet data cellular network—the AirCommunicator has the advantage of working wherever a cellular phone works. It also has the disadvantages of being slower, less dependable, and more expensive to use.

Using Air Communications' AirTrue technology, the AirCommunicator raises cellular data transmission to a new level of fidelity. The software senses the events that most often throw off cellular phones, such as cell changes and frequency hops, and continually adjusts the phone's operating parameters.

Our experience was that the AirCommunicator was either a boon or a bust depending on where we used it. For example,

using NYNEX Cellular as our service provider at our New York office, it took more than a dozen attempts to get a connection that was strong enough to send a fax



DOWNLOAD ON THE GO: The AirCommunicator Lite moves data over the existing cellular network.

or to work with CompuServe or MCI Mail. Typical connections lasted a few minutes, and the maximum transmission speed we reached was 4,800 bits per second. This makes the AirCommunicator too slow to use the Internet effectively via a cellular link but fine for hit-and-run computing or e-mail.

By contrast, an hour north of Manhattan, in Greenwich, Connecticut, the system ran without a hitch and stayed connected for as long as 45 minutes at a time. We were able to maintain a good line as we drove in and out of transmission cells. And the top reported data speed was in excess of 22 Kbps.

Battery life was adequate. We were able to use the phone for voice conversations for about an hour and a half before the battery died; the phone can sit in standby mode, ready to accept a call, for about 8 hours.

Expect to get only about 40 minutes of data-transfer time from the battery, though. After the phone automatically shuts down, there's enough power left to make a few quick phone calls using the battery.

The system's nickel cadmium battery uses an awkward snap-on power charger, but it really needs a cradle that you can drop the phone into for convenient charging. Though the phone's AirController software includes a bar graph depicting the amount of battery time remaining, the addition of a countdown box would help to squeeze the most out of the last few minutes of battery time left.

Compared to the radio frequency-based Ardis or RAM Mobile Data networks, which also allow the transmission of e-mail and faxes, the AirCommunicator offers the ability to connect interactively. This feature allowed us to do things such as dial-in to our corporate network, use a commercial online provider to scan the current headlines or weather map, and participate in a chat session.

Though it is generally a robust and well-designed cellular phone, there are several nice extras, such

phone while it is in use can be awkward, particularly if you're in a car.

In addition, the AirCommunicator offers two must-have options for frequent travelers. First, the \$200 AirDock lets you use the AirCommunicator with a standard phone line's RJ-11 jack and serves as a speakerphone and charger cradle. Second, the \$140 nickel hydride battery pack can nearly double online time.

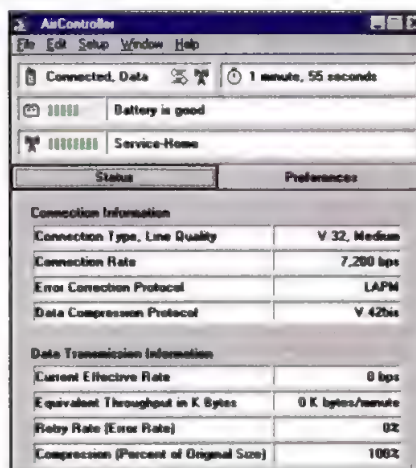
STATUS CONSCIOUS

The AirCommunicator's excellent AirController software is a hidden gem. It takes only a few minutes to get the phone up and running. An informative status screen, which contains all relevant connection information, can be configured as a large floating window or as a dockable summary bar. There's even a database that keeps tabs on your usage.

As future updates to the firmware become available, Air Communications will make them available as a download directly to the phone. All you'll have to do is press two buttons on the phone and confirm the operation.

This spring Air Communications will introduce the AirCommunicator Executive, a phone that is similar to the Lite version but should be smaller, lighter, and more capable—as well as more expensive. The Executive uses longer-lasting lithium ion batteries and will hold up to 16 minutes of phone messages. Present Lite models are upgradable to the Executive.

The minor shortcomings of the AirCommunicator Lite are to be expected of a device that is breaking new ground in the integration of cellular technology and computing. For the traveling executive, the AirCommunicator Lite is an excellent way to free the notebook computer from its phone cord and still stay in touch. **AirCommunicator Lite.** Estimated street price: \$550. Requires: PC with serial port for data transfers. Air Communications Inc., Santa Clara, CA; 800-247-3282, 408-567-8000; fax, 408-567-9090. Circle 434 on reader service card.



WHAT'S GOING ON: The phone's status screen shows speed and protocol, as well as other information.

as the mute button and backlit LCD screen. On the other hand, the serial cable, which connects the phone to a PC, plugs into the phone's bottom, so balancing the

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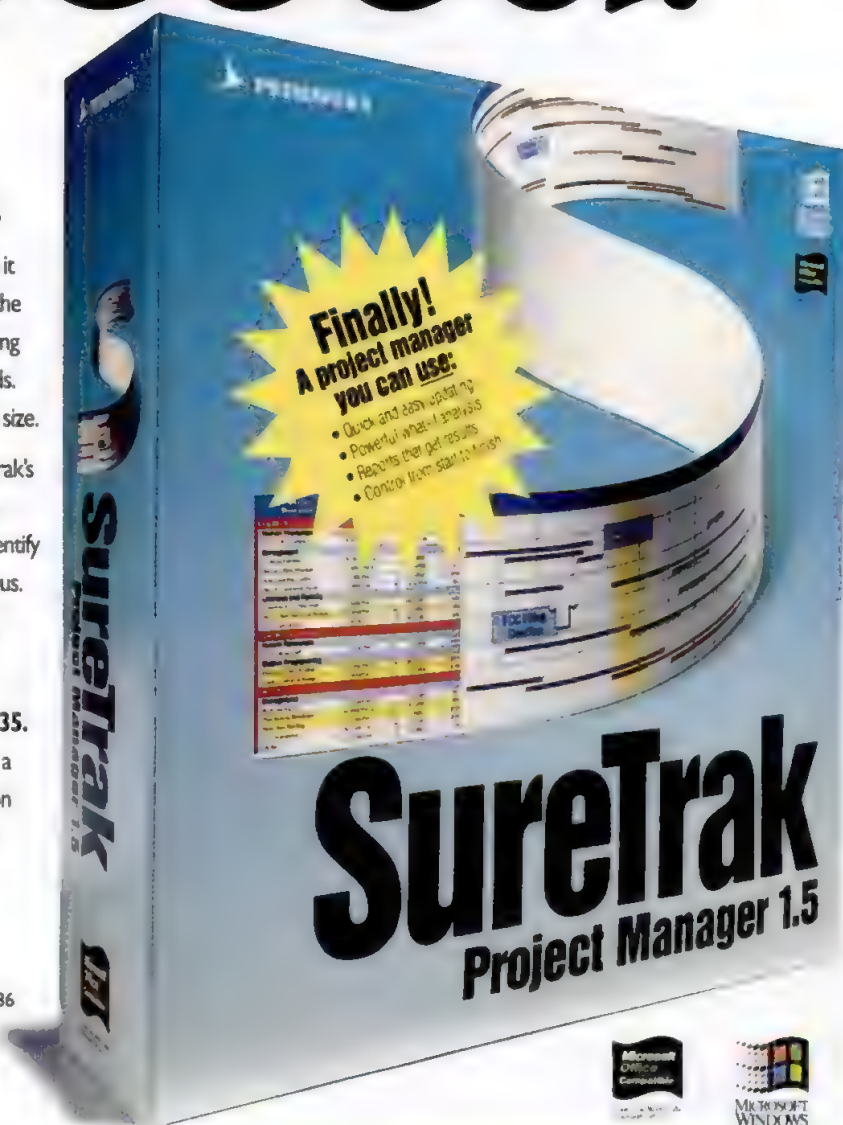
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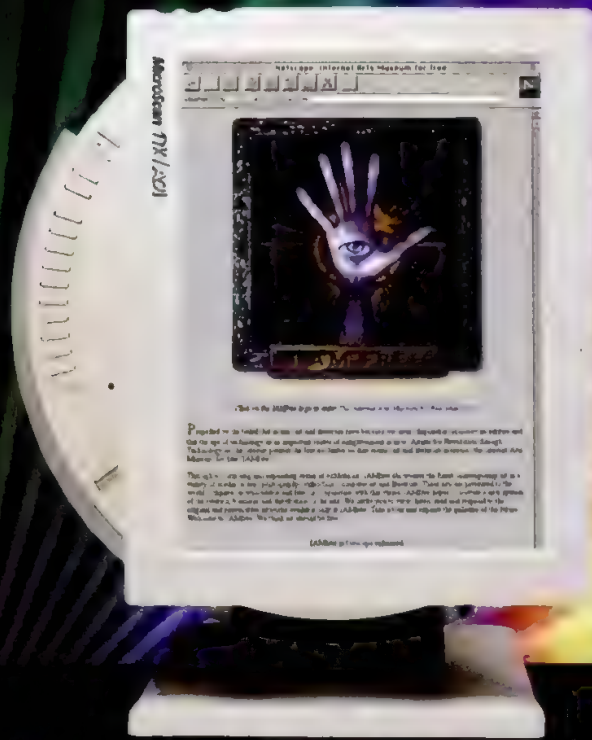
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CIRCLE 148 ON READER SERVICE CARD



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The MicroScan 17X also has many other things to flip over. Like a 17" CRT display with a 16" diagonal viewing area, 1024 x 768 resolution, flicker-free 76Hz performance, .28mm dot pitch, microprocessor digital controls, even Plug-n-Play compatibility. It's a feature set you won't find in competitively priced monitors. And since ADI builds monitors for leading PC companies worldwide, you know you're making a quality investment for the long haul. The MicroScan 17X is also backed by a three-year warranty. Best of all, you don't have to be a Web Master to get one. Just call 1-800-228-0530 for your nearest dealer.

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CIRCLE 226 ON READER SERVICE CARD

DESKTOP PUBLISHING

Corel's Print House: The Easy Way to Do Desktop Publishing

By Arie Moller

Whether it's a customized card for a birthday party or a brochure for your new business, Corel Corp.'s Print House for Windows 95 offers a quick and easy way to produce professional-looking publications. Though the \$99 Print House is engineered for the graphically challenged, there is a rich selection of tools and content, from photos to art to stock phrases.

The tabbed Notebook interface provides easy access to Print House's catalog of clip media, styles, and online help. The Styles page includes suggested styles for different types of publications. There are also six QuickWay templates that help you to start creating brochures, cards, and banners in minutes.

The Print House CD-ROM includes 5,000 pieces of clip art, 1,000 phrases, 1,000 photos, and 200 backdrops. All of these elements can be dragged-and-dropped from the Notebook page onto your project. Each image contained in the Notebook is represented by a thumbnail.

Print House provides the basic art tools for lines and circles but not much more. The context-sensitive Key page guides you step-by-step through basic tasks apropos to the tool or object you are using.

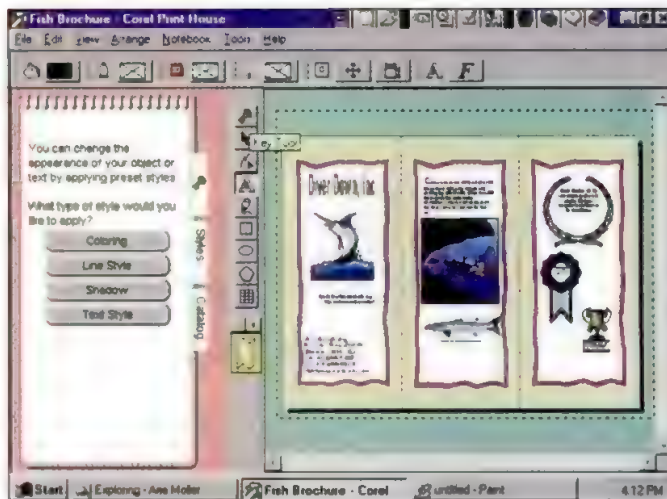
For more complex tasks, Print House provides wizards for step-by-step assistance. For example, the Color Wizard guides you through such tasks as creating a gradient fill. Print House supports conical, linear, radial, and square fill patterns.

Two Print House features stand out: First, the program supports PaperDirect's 500 templates for using the company's specialty papers to add a professional touch. Second, Print House has a novel way of handling image boxes.

Clicking on any box toggles among controls for resizing the image and tilting or rotating the box.

A few bugs marred an otherwise impressive first effort. For instance, if you attempt to insert text before adding a backdrop, the text is obscured and the program provides no option for bringing it to the foreground. Also, when saving a .PCX file, Print House prompts you that the Help file is missing.

For those intimidated by likes of Adobe PageMaker or QuarkXPress, Corel Print House for Windows 95 makes simplicity and ease of use paramount.



CLICK AND PRINT: Print House's Notebook screen provides quick access to features such as predefined document styles.

Print House for Windows 95. List price: \$99. Requires: 8MB RAM, 10MB hard disk space, Microsoft Windows 95, CD-ROM drive.

Corel Corp., Ottawa, Ontario, Canada; 800-772-6735, 613-728-8200; <http://www.corel.com>. Circle 428 on reader service card.

MULTIMEDIA AUTHORIZING

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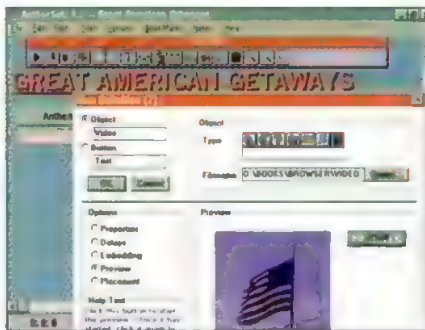
By Shane Mooney

Thanks to Spirit of St. Louis Software's \$99.95 AuthorSoft 3.1, you don't have to be a computer programmer to produce professional-looking multimedia presentations or full-blown marketable multimedia programs. Though slightly more complex than other entry-level multimedia authoring programs such as Illuminatus or Neobook, AuthorSoft trades a steeper learning curve for more options and superior control over the content.

The key to AuthorSoft, which comes on a CD-ROM, is that there is no scripting. Regardless of a piece's complexity, AuthorSoft begins with a virtual blank canvas to which you add one of a wide variety of included backdrops. Then you place the multimedia elements you want direct-

ly onto the page. Next, you create a movable heading or caption with Windows fonts and colors.

To include audio, you place an invisible sound box on the page;



DESKTOP DIRECTOR: AuthorSoft gives you powerful options for integrating audio and video into your presentations.

double-click on it to select MIDI or .WAV audio. This is where AuthorSoft's multiple options really help. You can program the music to start automatically after a timed delay or after a predetermined action by the end user, or to repeat continuously.

For video, you can use .AVI

video files or .FLI/.FLC animation files. In addition, still photographs may be used as stand-alone art, part of a slide show, or even as dynamic links to other parts of your program or document. These images can also be designated as hot spots that change the cursor's icon from an arrow to a graphic of your choice.

When you're finished, AuthorSoft compiles the final program. Spirit of St. Louis Software includes a royalty-free viewer so that you can create and distribute your own multimedia software.

One thing we didn't like is that AuthorSoft does not come with any printed documentation. At times, we were forced to open several of the online help windows simultaneously just to make it through the tutorial.

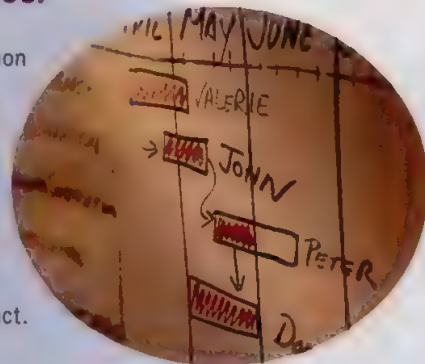
AuthorSoft is an excellent entry-level authoring tool with enough power to publish slick multimedia presentations.

AuthorSoft 3.1. List price: \$99.95. Requires: 4MB RAM, 6MB hard disk space, CD-ROM drive, audio card, Microsoft Windows 3.1 or later. Spirit of St. Louis Software, Chesterfield, MO; 800-709-6090, 314-530-0757; fax, 314-530-7350. Circle 429 on reader service card.

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Monthly Calendar report to share your plan in a format that's clear and easy to read. And since Microsoft Project shares many of the same key commands with other Office applications, it will be easy to create schedules and reports.

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 Start



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Microsoft Project is the world's best selling project management software and now is optimized to work hand-in-hand with the 32-bit performance, advanced multitasking, and simplified user interface of the Windows 95 operating system. Together, they help open the lines of communication. Together, they help you enhance the way you manage your projects.

MBWARE

PlanMaker 2: A Useful Program In an Unpolished Package

By Craig Stinson

PowerSolutions' \$129 PlanMaker 2 is a Windows transplant of the company's DOS-based tool for generating business plans for small- to medium-scale start-ups. Unfortunately, Version 2 suffers from a lack of integration with word processing and spreadsheet programs and an unrefined interface.

The program comes with three sample plans: a desktop publishing start-up, a restaurant (suitable for any retail business), and a manufacturing operation. You can crib freely from these samples via copy-and-paste operations to help build your own plan.

If the venture you're hoping to finance is similar to one of these, PlanMaker may prove helpful. The program's questionnaire can help new entrepreneurs focus and present their thoughts coherently. The on-screen interview prompts you to describe your business and type in the necessary data to compile a convincing business plan.

Unlike Jian's BizPlanBuilder, which works within your existing software, PlanMaker is a stand-alone product that requires you to use its own text processing and number-crunching tools. Aside from the Windows Clipboard, there's no way to import material from or export it to standard word processors, spreadsheets, or charting packages.

Moreover, the program offers no way to create tabular material within the narrative components of your business plan, no spell-checker or grammar checker, no search-and-replace command, no command for editing headers and footers, and no print preview. PlanMaker provides fill-in-the-blank forms to tabulate and recalculate such things as loan amortization and depreciation. You may be able to live with these forms, although working in

your own spreadsheet would give you more flexibility and also let you generate a variety of charts.

Aside from its functional limitations, PlanMaker's interface seems somewhat crude in the Windows 95 era. As we went to press, PowerSolutions released Version 2.02 of PlanMaker, which addresses some of our concerns.

WINDOWS 95 UTILITIES

PowerDesk: What Explorer and Dashboard Should Have Been

By Edward Mendelson

MicroHelp's \$39.95 PowerDesk combines the best of Windows 95 file manager and the best Windows 95 on-screen control-center toolbar. Each looks good and offers impressive customizability and power.

The control-center module, called the PowerDesk Toolbar, resembles Starfish Software's Dashboard 95

VIEWER: Explorer Plus, the PowerDesk file manager, looks like the Windows 95 Explorer but adds drive icons and a file-viewer window. The Toolbar lets you access files, programs, printers, and other resources.

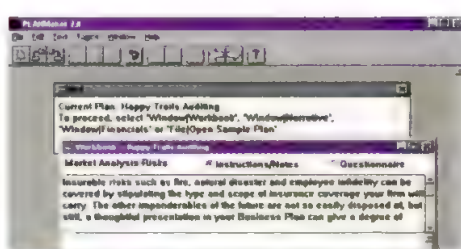


but has a far more sensible and usable design. With the Toolbar, you can import and display the icons you choose from your desktop or the contents of your Start menu or of any custom menu. There are icons for selecting a printer, a DOS command line, a miniature display of virtual screens, buttons for a quick Windows shutdown or restart, and a variety of system gauges. All of the elements can be arranged in the order you want

In particular, the update allows you to print questions and answers and adds a search-and-replace function.

As a training manual for start-up businesses, PlanMaker may be useful. Then again, a day at the public library might serve you just as well. As software, PlanMaker comes up short.

PlanMaker 2. List price: \$129. Requires: Microsoft Windows 3.1 or



BUSINESS TUTOR: PlanMaker's questionnaire and tips guide you toward a completed plan.

later. PowerSolutions for Business, St. Louis, MO; 800-955-3337, 314-421-0670; <http://www.planmaker.com>. Circle 403 on reader service card.

toolbar can be customized.

Explorer Plus is closely integrated with Windows 95, so the pop-up menus in Explorer Plus include any shell extensions that you added to Windows itself. PowerDesk adds its own extensions to the pop-up menu for zipping, copying, and moving files. These resemble the additions to the pop-up menu that are installed by The Norton Navigator, but PowerDesk's extensions have better-designed dialog boxes and keyboard shortcuts that Navigator doesn't provide. MicroHelp doesn't document the fact that expert users can edit the Windows 95 Registry to launch Explorer Plus instead of Explorer when opening folders or drive icons from the desktop.

The main drawback of Explorer Plus is the inconsistency of some of its keyboard shortcuts with standard Windows keys. For example, Shift-F10 should bring up the right-click pop-up menu but instead doesn't do anything. Explorer Plus also lacks a keyboard shortcut or icon for inverting the sort order of file lists. All of these problems will be fixed by a patch later this year.

Meanwhile, Explorer Plus is already by far the best file manager for Windows 95.

PowerDesk. Estimated street price: \$39.95. Requires: 4MB RAM, 2MB hard disk space, Microsoft Windows 95. MicroHelp Inc., Marietta, GA; 800-777-3322, 770-516-0899; fax, 770-516-1099. Circle 404 on reader service card.

the drop-down menus that are based on the Start menu.

The file-manager module, called Explorer Plus, looks a lot like the Windows 95 Explorer but does far more. An optional viewer pane below the file and drive panes uses Windows' own Quick View viewers to display files as you browse through the list. A row of drive icons ends the headache of changing drives in the Windows 95 Explorer, and the file management

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UTILITIES

ClickBook: The Smart Printer Driver

By Barry Simon

BookMaker Corp.'s ClickBook is an elegant, functional utility that makes it easy to format and print everything from brochures to business cards. The \$69.95 ClickBook 2.0 adds Windows 95 support and a raft of new features, including the ability to combine multiple documents into a single brochure, the ability to print only a portion of the output, and new templates for faxes, business cards, and CD jewel boxes.

ClickBook works by installing appropriate Windows printer drivers. The program includes the drivers for many popular printer models, and it is a breeze to set up drivers for additional printers manually.

To begin, you select a layout in a dialog box that pops up whenever you print to a ClickBook driver. The program intercepts the print job and reformats it, reducing the text size and rotating the pages to suit the layout and page pattern you chose.

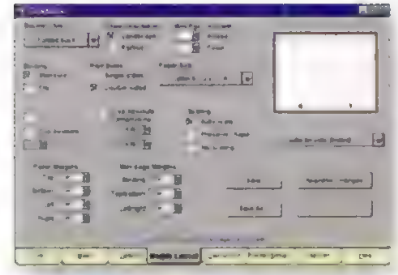
ClickBook ships with enough templates to meet the needs of most users, and it is not difficult to add your own. You can create single- or double-sided publications in two- or threefold for-

mat. The program can also print multiple copies of the same text on a single page, a feature that is useful for creating business cards or small posters.

New to this version is the ability to print a ClickBook to a file. In addition, Version 2.0 supports Windows 95 features, such as long filenames and the ability to rename printers.

On the whole, we found ClickBook to be a wonderful program that extends the abilities of your PC and printer.

ClickBook 2.0. List price: \$69.95; upgrade, \$19.95. Requires: 4MB RAM, 1MB hard disk space, Microsoft Windows 95 or Windows 3.1. BookMaker Corp., Palo Alto, CA;



TEXT TAMER: ClickBook transforms text into brochures and other formats.

800-766-8531, 415-354-8161; fax, 415-856-4734. Circle 431 on reader service card.

MULTIMEDIA ADD-ONS

Pump Up Your PC with the AKS BassPump

By Steve Buehler

If you think your new multimedia computer lacks good bass response, you'll find a solution in the \$149 AKS BassPump, a subwoofer that fills in those missing low tones to give your PC full frequency response.

The BassPump is a standalone 30-watt subwoofer housed in an 8- by 14- by 9-inch box. A 6.5-inch speaker provides the range necessary to produce really low tones. The BassPump connects to your current sound system through an in-line splitter cable, which makes installation and setup easy.

We tested the BassPump with a multimedia PC that was equipped with a pair of Altec Lansing ACS5

speakers. The BassPump nicely complemented the desktop speakers, adding up to 15 dB of bass.



LOW END: The BassPump boosts a speaker's bass response.

On the whole, the BassPump exhibited an excellent frequency response of 20 to 525 Hz (6 dB) and impressive loudness (92 to 101 dB) across that range. The

subwoofer's sound quality was very good, with clear, solid bass tones and no annoying buzzing or air-movement sounds.

The BassPump had two minor shortcomings: The unit passes all signals to the speaker, forcing the speaker to work a little harder than necessary. And there's no built-in volume control. But you can buy an optional volume-control unit (\$5), which patches into the BassPump's splitter cable.

Once you've tried this box with a PC and desktop speakers, you won't want to go back.

AKS BassPump. List price: \$149. AKS Acoustics, Wilton, NH; 603-654-5388. Circle 430 on reader service card.

PROGRAMMING

Wise Installation System Makes Software Installation a Snap

By Jay Munro

The \$199 Wise Installation System 4.0, from Great Lakes Business Solutions, simplifies the installation of a program with an easy-to-use tool that helps you create installations that can be handled by anyone from the brain-dead to the brain surgeon.

The Wise Installation System creates a single, self-installing executable (16-bit, 32-bit, or both) from your program files. You can break up large files or span disks,

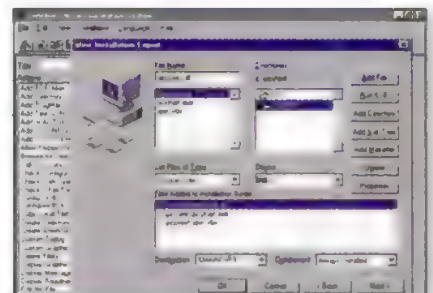
if needed. The installation is governed by scripts you create within the Wise environment, a GUI drag-and-drop script editor that lets you drag to select actions the installation will take. Actions include checking the system date, copying files, issuing a prompt for a directory, and more.

The Wise installation system has addressed some of the more painful areas of Windows development, such as finding all DLLs that are associated with an exe-

cutable. The Run .EXE feature lets you run your program while Wise monitors referenced .DLLs, .OCXs, and .VBXs and adds them to your install-file list.

On the downside, the instruction manual was inconsistent. Some sections were written for beginners and others for experts. Developers will find that Wise Installation covers their installation needs with the power and flexibility that they strive to put into their own programs.

Wise Installation System 4.0. List price: \$199. Requires: 8MB RAM,



START YOUR PROGRAM: Wise Installation is an intelligent tool for programmers.

4MB hard disk space, Microsoft Windows 95, Windows NT, or Windows 3.1 or later. Great Lakes Business Solutions, Canton, MI; 800-554-8565, 313-981-9931. Circle 432 on reader service card.

FOUR REASONS WHY PORTABLES



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Second Looks

LIVING WITH THE PRODUCTS WE REVIEW

By Brian Nadel

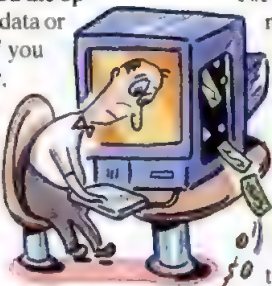
PERSONAL FINANCE

The Case of the Lost Data

THE LAST THING YOU want from an accounting or personal finance program is the loss of precious data about your family's finances. On two counts, that's exactly what Editors' Choice winner Quicken 5.0 can do ("Personal Finance: Banking on Your PC," January 23, 1996).

First, if you try to delete a subcategory—say, Insurance—

Quicken 5.0 gives you the option of merging the data or deleting it. Even if you choose the former, you can lose some records. Another software glitch keeps Quicken 5.0 from finding some transactions when you run the File



Validate feature. The data isn't actually gone, but Quicken can't lay its hands on it, which results in some transactions showing up as

N/A on the register. All is not lost: In most cases, you can recover the missing records from backup data that Quicken keeps.

In addition, it can also seem as though Quicken is sucking up as much of your system's resources as possible. According to Intuit, this is not an accurate reflection of the software's requirements, but the result of an errant PeekMessage loop, which allows Quicken to perform some of its tasks in the background. Regardless of whether the PC shows that it is maxed out, there is room for other applications to run.

Intuit will mail a patch that fixes the first two data-related problems to all registered Quicken 5.0 users. If you're in a hurry to balance your checkbook, the fix is available immediately on Intuit's CompuServe forum as well as the company's Web site (<http://www.intuit.com/quicken/>). As for the bug that seems to want all of your PC's resources, Intuit is currently working on a software fix that should be ready by the time you read this.

With these updates, the check really will be in the mail—that is, if you meant it to be.

UNINSTALLERS

CleanSweep's Instant Update

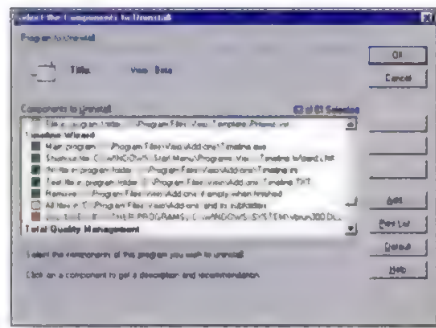
WHEN WE REVIEWED QUARTERDECK'S CLEANSWEEP95 (First Looks, January 9, 1996), the first of an expected series of Windows 95 uninstaller utilities, we encountered several problems that detracted from an otherwise solid approach to removing the detritus that Windows 95 applications can leave behind. Apparently, Quarterdeck agreed. Less than a month after CleanSweep 95 first appeared on our doorstep, updated disks arrived.

The update, which bears the moniker Version 2, replaces 21 program files and is available on Quarterdeck's Web site (<http://www.quarterdeck.com>) and the company's CompuServe forum. While it doesn't address all our concerns, the revamped program goes a long way to helping smooth out CleanSweep's rough start.

Specifically, the updated version works better with other utilities like Microsoft's Defrag and Norton's Speedisk. CleanSweep continues to show safely removable items with a green light, questionable ones with a yellow light, and dangerous ones with a red light. Version 2 of CleanSweep 95 takes a decidedly more conservative approach to weeding out

extra files, so expect to see more yellow and red lights.

Unfortunately, CleanSweep can still take close to a minute to scan a large hard disk that contains many programs. A performance optimization update seems to be the next task for Quarterdeck.



LOOKING AHEAD

Tell me what you love and hate about these products and we'll share the information in future issues. Apple PowerBook 5300 • Digital cameras • First Aid 95 •

Flowcharting programs • IBM ThinkPad 760 CD • Logitech PageScan • Microhelp Power Desk • Multifunction peripherals • Quad-speed CD-ROM drives •

SoftWindows • Windows 95 Utilities. Contact Brian Nadel directly via MCI Mail (556-1500), CompuServe (72241,1616), or on the Internet at bnadel@zd.com.

BUG BRIEFS

PROBLEM

► Iomega's extremely popular Zip drive (First Looks, June 27, 1995) doesn't work with Caere's PageKeeper document management software.

SOLUTION

Caere suggests the following configuration changes to make PageKeeper and the Zip drive cooperate: Remark out the `Guest.exe` line in the `AUTOEXEC.BAT` file, then install or run PageKeeper. This program allows for hot swapping, so this change will require that the drive be turned on when the computer boots. If your troubles persist, try removing the "ZipTool" icon from the Windows Start Up window. If you do this, you'll need to eject cartridges manually.

PROBLEM

► Due to an incompatibility between Intel's Neptune chip set and the Plug and Play protocol, owners of early 90-MHz Pentium Micron PowerStation systems who upgraded to Windows 95 may have experienced erratic operation and random system shutdowns.

SOLUTION

Two revisions to the Phoenix BIOS 4.04 M54 are available on Micron's bulletin board service (208-465-8982): Revision 15 (for AT computers) and revision 19 (for PS/2 computers) enable the systems to run just as well under Windows 95 as Windows 3.1.

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June 1995



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* Two year warranty on CRT. † Requires a DDC compatible video card. © 1995, CTX International, Inc.

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New & Improved

NEWS OF ANNOUNCED PRODUCTS AND UPGRADES

By Melissa J. Perenson

WinBook Packs Pentium Power

THE PRICE/PERFORMANCE GAP BETWEEN DESKTOP AND notebook PCs has been closed even further by the \$2,999 **WinBook XP5 P120**. The specs for this latest portable from WinBook Computer Corp. read like those for a dream machine, as long as your dream machine doesn't require an internal CD-ROM drive.



The 6.1-pound WinBook XP5 P120 comes standard with 16MB of RAM, a 1.3GB removable hard disk, 256K of cache, a 10.4-inch active-matrix display, a nickel hydride battery, integrated 16-bit stereo sound with line-in and line-out jacks, and a built-in microphone.

There's also an integrated trackball and pointing stick.

If you want a CD-ROM drive, there are two options: a \$399 quad-speed CD-ROM docking station or a

\$199 external double-speed CD-ROM that attaches via a PC Card slot. An internal 14.4-Kbps modem comes standard; you can upgrade to a 28.8-Kbps modem for \$249.

WinBook Computer Corp., Columbus, OH; 800-468-2162; fax, 800-448-0308. *Circle 413 on reader service card.*

Card Storage

HAVING SOME PROBLEMS making the most of your notebook computer now that you've outgrown your hard disk? Calluna Technology's **callunacard** provides an alternative



source for high-capacity data storage. The callunacard, which is available in 260MB and 510MB capacities (\$599 and \$699, respectively),

is a Type III PC Card that has data-transfer rates of up to 11 megabytes per second and an average seek time of 16 milliseconds. The card is protected from viruses and unauthorized access by a two-level password utility. **Calluna Technology**, San Jose, CA; 408-453-4753; fax, 408-453-0427. *Circle 414 on reader service card.*

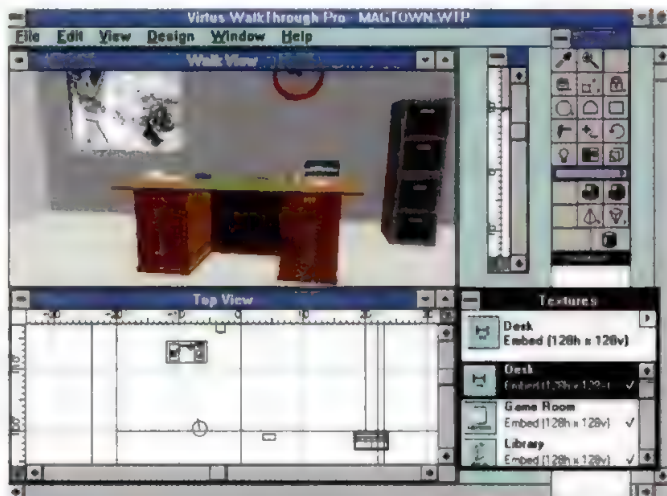
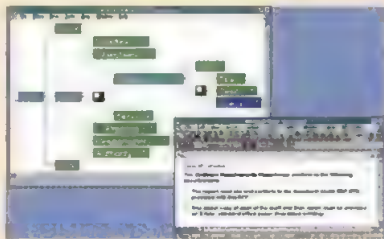
SGML Moves Nearer and Nearer

Not so long ago, Standard Generalized Markup Language (SGML), like its now-ubiquitous subset, Hypertext Markup Language (HTML), was a complex obscurity. But SGML is now migrating to the mainstream, too, thanks to innovative programs such as Microstar Software's \$399 **Near & Far Author for Microsoft Word 6.0**.

Designed as an add-on for Word, Near & Far enables you to create structured SGML documents without having to leave your familiar Word environment. No prior knowledge of SGML is necessary, since Near & Far uses a graphical, tree-view model of your document to provide a guide to the document's structure and style.

The software walks you through the creation of documents that are structured by SGML. You can save a file in either SGML or Word formats; similarly, you can import and export SGML documents as well. Because Near & Far is integrated into Word, there's the added advantage of familiarity, as the Near & Far toolbar has a comfortable feel, and all the expected formatting styles and printing commands that come with Word.

Microstar Software Ltd., Bells Corners, Ontario, Canada; 800-267-9975, 613-596-2233; fax, 613-596-5934. *Circle 426 on reader service card.*



PERSPECTIVE: Virtus WalkThrough offers multiple views of your document.

VRML Visuals

FOR POWERFUL 3-D MODELING, turn to Virtus Corp.'s \$495 **Virtus WalkThrough Pro Version 2.5**. A fully navigable profession-

al modeling, visualization, and world-building tool, this package is highlighted by the ability to export renderings as VRML files for publication on the World Wide Web. Also new is support for stereoscopic viewing hardware. Virtus Player, a freeware utility and real-time player for viewing your 3-D models, is included as well.

Virtus Corp., Cary, NC; 800-847-8871, 919-467-9700; <http://www.virtus.com>. *Circle 411 on reader service card.*

Upping the Ante

MUSTANG SOFTWARE'S \$129 **QModemPro for Windows 95 Version 2.00a** is a slipstream release that is strengthened by some new features. You can force telnet binary operation, and you can now telnet to a specific telnet port address. The direct-connect feature automatically searches for an open COM port. And downloaded files can now have filenames exceeding 30 characters.

Mustang Software Inc., Bakersfield, CA; 800-999-9619, 805-873-2500; fax, 805-873-2599. *Circle 412 on reader service card.*

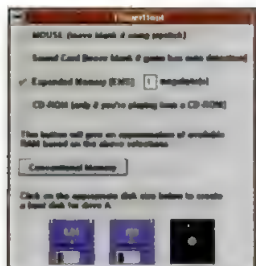
A Magic Act

ARE YOU TIRED OF LOSING valuable hard disk real estate because of a poorly partitioned drive but unwilling to undergo the multistep nightmare associated with repartitioning a drive? PowerQuest Corp.'s \$49.95 **PartitionMagic 2.0** for DOS and Windows 95 (OS/2 version, \$69.95) will help you alter the balance on your hard disk by letting

you modify your partition configuration on the fly, without affecting your data. This way, you can reclaim hard disk space by reducing your cluster size. An indispensable utility, PartitionMagic's easy-to-use, efficient interface means that partitioning a hard disk is no longer relegated to the realm of power users.

PowerQuest Corp., Orem, UT; 800-379-2566, 801-226-8977; magic@powerquest.com. *Circle 418 on reader service card.*

The Power to Play Your Games



IF YOU'RE STILL HAVING TROUBLE getting that game you bought for Christmas to work on your PC, try The Software Labs' \$34.95 **Power2Play**, which will let you play even the most recalcitrant of resource-hungry DOS games while running Windows 3.1 or Windows 95. Most games run by a single click from the Power2Play menu without any user intervention; some games require you to answer four simple yes/no questions about the game's requirements.

The Software Labs, Redmond, WA; 800-569-7900, 206-869-6802; <http://www.softwarelabs.com>. *Circle 416 on reader service card.*

At the Automat

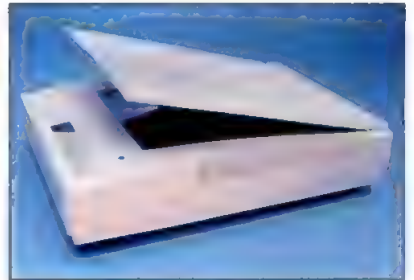
CAPSOFT DEVELOPMENT Corp.'s \$99 **HotDocs 3.0** improves on past incarnations of this document-automation software with increased speed and greater functionality. HotDocs offers an easy

way to turn most Windows word processor documents into automated templates that prompt you for case-specific information; over 20 templates are included.

Capsoft Development Corp., American Fork, UT; 800-500-3627, 801-763-3900; fax, 801-763-3999. *Circle 415 on reader service card.*

Scanners Achieve a New Price/Performance Balance

IF YOU'RE STILL SEARCHING FOR A TRULY AFFORDABLE flatbed scanner that doesn't sacrifice features or functionality, then your search may be over with the **Primax DeskScan Color**. The \$399 DeskScan Color is a versatile, three-pass flatbed scanner with 600-dot-per-inch (dpi) opticals that supports 24-bit resolutions of up to 1,200 dpi interpolated, as well as standard 256-level gray-scale support. A SCSI interface card, Twain drivers, and scanning software are bundled.



VERSATILITY: Primax's \$399 DeskScan Color makes flatbed scanning affordable.

Targeting a similar audience is Tamarack Technologies, which has enhanced the performance of its \$469 **ArtiScan Pro**

6000C. A 24-bit, 300- by 600-dpi flatbed scanner, it produces true-color output and features improved scanning speed.

Primax Electronics, Sunnyvale, CA; 800-338-3693, 408-522-1200; fax, 408-522-1299. *Circle 419 on reader service card.*

Tamarack Technologies Inc., Orange, CA; 714-744-3979; fax, 714-744-4582. *Circle 420 on reader service card.*

Conversions and More

DATAVIZ, ONE OF THE INDUSTRY LEADERS IN DOCUMENT and Mac-to-PC file conversion, now offers a 32-bit version of its **Conversions Plus Version 3.5 for Windows**. This \$149 package features new translators for Excel for Windows 95, Word for Windows 95, WordPerfect 3.5 for the Macintosh, WordPerfect 6.1 for DOS, and Works for Windows 95. You can also retain long PC filenames; convert entire directories; read, write, and format Mac floppy disks; and read Mac CD-ROMs.

DataViz Inc., Trumbull, CT; 800-733-0030, 203-268-0030; fax, 203-268-4345. *Circle 417 on reader service card.*

BRIEFS

Books

In Life on the Screen: Identity in the Age of the Internet, MIT sociologist and psychologist Sherry Turkle uses examples such as online relationships and MUDs (multiuser dungeons) to argue that online activity is reshaping our concept of human identity (\$25, Simon and Schuster, 800-223-2348) Most computer books teach you how to make software or hardware work. **Create Wealth with Quicken**, by Christopher E. Vogt, teaches you how to make the latest version of the popular financial planner work for you (\$21.95, Prima Publishing,

800-255-8989) The growth of the Internet has heightened interest in computer security. In **The Underground Guide to Computer Security**, Michael Alexander discusses techniques for protecting your hardware and software—all in an offbeat style that helps to demystify a complex topic (\$19.95, Addison-Wesley Publishing, 800-447-2226).

Hardware

Fuji Computer Products is offering the \$19.95 **FujiFilm ATOMM Zip Disk 100**, a 100MB disk that's compatible with Iomega Corp.'s Zip

drive. The ATOMM technology provides a thin, high-density layer of magnetic material for improved performance and durability and fewer dropouts (800-488-3854) **TEAC's CD-56E** is a \$250 internal 6X drive that features a data-transfer rate of 900 KBps and an average access time of 140 milliseconds (213-726-0303).

Software

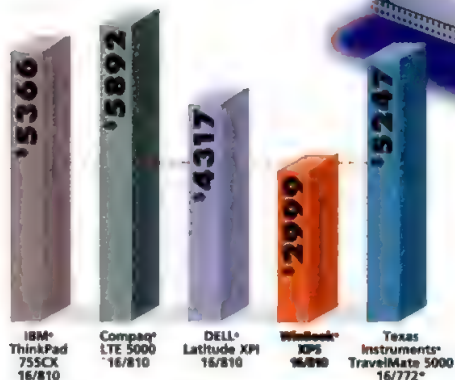
JE Software's \$29.95 **Print Screen** is an excellent utility that brings your Print Screen key back to life under Windows by printing the

PENTIUM® CHIP, LITHIUM, 16MB, TFT.

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PC Laptop's
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— January 1996



Prices quoted over 1-800 lines as of 11/10/95 for identically equipped models with 75MHz Intel Pentium® processor, lithium ion battery, 14.4 fax/modem, and 256K cache, from IBM PCDirect, Dell Computer Corp., WinBook Computer Corp., Compaq Direct Plus, and Texas Instruments

* Includes two lithium ion batteries

Winner of PC Laptop's annual Editors' Choice Award — the WinBook XP5 gives you the features you want in the highest quality, best value notebook. At \$2999, you get an amazing list of standard features including: Intel Pentium® processor, lithium ion batteries, 10.4" TFT active matrix screen, 16MB RAM, an 810 MB hard drive, and more.



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- PCI integrated graphics accelerator and 1MB of VRAM standard, upgradable to 2MB or Matrox Millennium PCI graphics card with 3D acceleration and 2MB of VRAM, upgradable to 4MB
- Flash BIOS for easy upgrade
- Full plug-and-play capability
- Designed for Windows 95
- Preloaded HP DMI250 Desktop Management Interface
- Free three-year limited warranty for parts and labor¹

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HP Vectra VL

Redefining network-ready PCs for the workgroup.

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- Leading Remote Management (HP DMI250) preinstalled
- PCI integrated 32-bit 10baseT Ethernet interface
- Network certified and preconfigured for Microsoft and Novell clients
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- Standard 256KB second level cache
- 64-bit graphics accelerator (Cirrus Logic 5434) on PCI bus
- 1MB of video RAM standard, expandable to 2MB
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- Enhanced-IDE controller on PCI bus
- 420MB** high-performance Enhanced-IDE hard drive
- 4 mass storage shelves (3 front accessible), 4 expansion slots
- Two 32-bit PCI slots
- Flash BIOS for easy upgrade
- Designed for Windows 95
- Free three-year limited warranty for parts and labor¹

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HP Vectra XM

The ultimate PC for advanced business and technical applications.

- Intel 120 or 133 MHz Pentium processors
- Supports dual processing with secondary processor socket
- 512KB second level burst synchronous write-back cache
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- 1,000MB** high-performance Enhanced-IDE hard drive
- Integrated 32-bit PCI Fast SCSI-2 and Enhanced-IDE interfaces
- Integrated PCI Matrox Millennium graphics card with up to 1600 x 1200 resolution
- 16MB of RAM standard, expandable to 256MB
- Integrated PCI 32-bit 10BaseT and Coax network interface
- Preloaded Desktop Management Interface (DMI)
- Free three-year limited warranty for parts and labor¹

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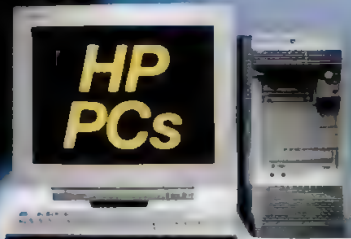
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**Exceptional performance
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affordable price.**

**The fastest PC
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- Intel Pentium Pro 150 MHz processor with 256KB integrated cache
- Supports dual processing with secondary Pentium Pro processor socket
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- 16MB of ECC DIMM memory standard, expandable to 256MB with 8 DIMM memory expansion sockets
- PCI integrated Ultra SCSI Fast 20 interface with 20MB/s throughput
- 1,000MB** SCSI-2 high-performance hard drive
- PCI Matrox Millennium graphics card with 3D acceleration and 2 MB of WRAM, upgradable to 4MB or 8MB
- 7 mass storage shelves (5 front accessible)
- 6 expansion slots: 3 PCI, 1 PCI/ISA combo and 2 ISA
- 10 BaseT/100VG AnyLAN selectable PCI NIC with up to 100 Mb/s throughput
- Integrated 16-bit audio and 4X CD-ROM
- Microsoft Windows NT 3.51
- Free three-year limited warranty for parts and labor*

from **\$5,159***



HP Vectra XU 6/150

- Intel Pentium Pro 150 MHz processor with 256KB integrated cache
- 128-bit high performance memory architecture
- 16MB of DIMM memory standard, expandable to 256MB with 8 DIMM memory expansion sockets
- 1,000MB** Enhanced-IDE hard drive
- PCI Matrox Millennium graphics card with 3D acceleration and 2MB of WRAM, upgradable to 4MB or 8MB
- 7 mass storage shelves (5 front accessible)
- 6 expansion slots: 3 PCI, 1 PCI/ISA combo and 2 ISA
- Integrated 16-bit audio and 4X CD-ROM
- Microsoft Windows NT 3.51 or IBM OS/2 Warp
- Free three-year limited warranty for parts and labor*

from **\$4,519***



HP Vectra VT

Since Compaq and IBM don't get the concept of 'value pricing,'

HP PCs would like to shed some light on the subject.

What it *doesn't* mean: bare-bones PCs with pared-down prices. **What it *does* mean:** PCs with all the features you need for much less than you'd expect to pay. Five prime examples are highlighted here. Compare their features and prices with the other leading brands, and you'll see why HP is the only one inviting comparison. Our entire line represents the best values in the business PC market. From value-priced Pentium® processor-based PCs to our blistering hot, dual Pentium Pro processor-based HP Vectra XU PC.

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Citizen's Newest Pocket Pal

PEOPLE WHO THOUGHT THEY DIDN'T NEED THE LUXURY of expensive portable printers should think again. Citizen America Corp. has expanded its line of ultracompact portable printers with the **Citizen PN50 Portable Printer**.

Priced at \$200, the PN50 weighs a mere pound and measures only 3 by 10 by 2 inches.



To achieve its high-quality output,

CITIZEN PN50: Pop it in your pocket.

Citizen uses its proprietary Thermal Fusion technology. This technology utilizes heat and pressure to bond dry resin-based ink onto the paper, to achieve 360- by 360-dpi output that verges on laser quality. Another distinguishing feature of the Citizen is its versatility; the device can print on a variety of paper stocks, including plain paper, laser paper, letterhead, envelopes, and transparencies. The unit can print up to 2 text pages per minute (ppm) using the friction-feed flat paper path. Power is provided either by an AC adapter or an optional rechargeable nickel cadmium battery.

Citizen America Corp., Santa Monica, CA; 310-453-0614; fax, 310-453-2814. *Circle 422 on reader service card.*

Bar Codes for One and All

ZEBRA TECHNOLOGIES VTI brings bar coding to the masses with **Barcode Anything**, a \$379 package that includes everything you need to get started.

The suite is a great bargain, even if the software integration is weaker than it should be. The suite comprises three components: Barcode Anything Label, for designing

and printing your own bar code labels; Barcode Anything Scan, which encompasses a lightweight wand that connects to your serial port and decoding software; and Barcode Anything Track, a customizable, FoxPro-based database.

Zebra Technologies VTI Inc., Sandy, UT; 800-477-5589, 801-576-9700; fax, 801-576-5538. *Circle 421 on reader service card.*

Practice Makes Perfect

IF YOU'RE PREPARING FOR HIGHER EDUCATION, THEN you're probably also facing the prospect of taking a standardized exam.

Davidson & Associates, which in the past has offered ACT and SAT software, expands its test-preparation line to include the **\$35 Your Personal Trainer for the GRE**. The software has a personalized training schedule, a diagnostic exam, problem-solving drills, and practice tests.

The Princeton Review Publishing goes beyond its PSAT and SAT multimedia products based on the company's popular test-prep courses to offer CD-ROMs for the graduate-school set. **Inside the GMAT**, **Inside the GRE**, and **Inside the MCAT** each include video lessons and animated responses, drills, and test-taking shortcuts, as well as practice exams.

If you're planning on taking multiple exams, try Xenon Education-

al Systems' \$35 CD-ROMs, **Score-Rx TwinPrep for the SAT I/ACT** and **Score-Rx MultiPrep for the GRE/GMAT/LSAT**. Each product includes three actual exams, a vocabulary builder, and test and tutor modes.

Stanford Testing Systems' **WebWare for the SAT** is a free service on the World

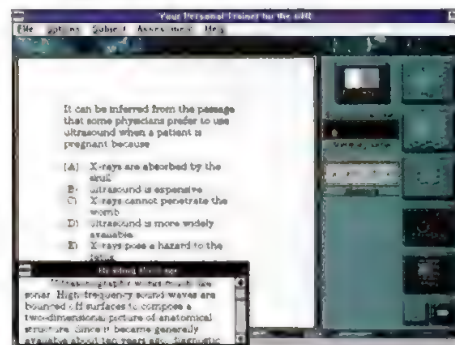
Wide Web that includes over 700 practice lessons and 47 skill lessons. Stanford offers software for the GRE and TOEFL at \$50 each; GMAT and LSAT software will soon follow.

Davidson & Associates Inc., Torrance, CA; 800-545-7677, 310-793-0600; fax, 310-793-0601. *Circle 423 on reader service card.*

The Princeton Review Publishing, New York, NY; 800-273-8439, 212-874-8282; fax, 212-874-0775. *Circle 424 on reader service card.*

Xenon Educational Systems Inc., Coral Springs, FL; 800-249-0302, 954-345-9209; fax, 954-341-2105. *Circle 440 on reader service card.*

Stanford Testing Systems Inc., Spokane, WA; 800-728-4950, 509-468-5100; <http://www.testprep.com>. *Circle 425 on reader service card.*



TEST PREP, PC STYLE: Davidson's *Your Personal Trainer for the GRE* is a personal study aid.

BRIEFS

active window or full screen to either a printer or fax driver. You can also opt to save your screen capture to a bitmapped file (800-431-1348) Autodesk's **\$295 Animator Studio Release 1.1** is a Windows 95 version of the company's 2-D paint and animation software (800-879-4233).

CAD Software

ICEM Technologies' **\$487 ICEMatrix** is a Parametric AutoCAD editor for use with AutoCAD Release 12 or 13. The software automatically re-creates a drawing whenever a user

changes one or more parameters (800-799-3932) Another AutoCAD Release 13 add-on is **AccuRender 2.1 for Digital Alpha**, a \$395 package that speeds up ray-trace rendering and animation when using Windows NT on a Digital Alpha machine (206-545-7000) FIT's **\$495 CADVance Lite 6.3 for Windows** is an entry-level CAD package (800-931-3171, 714-956-3171).

Internet

Beyond 2000 Systems' **WebWerx** is a \$9,995 turnkey World Wide Web-server package

that includes a 100-MHz Pentium server, Windows NT-based software, and support for businesses (800-441-2282) AimTech Corp.'s **\$4,995 IconAuthor 7.0** upgrades this Windows 95 and OS/2 visual-authoring tool so that you can now create interactive multimedia applications for delivery on the Internet (800-289-2884) Bonzi Software's **\$29.95 Voice E-Mail 3.0**, which was previously available for America Online and CompuServe, can now be sent over the Internet using Eudora and Netscape Navigator; a Prodigy version is also available (805-238-5790).

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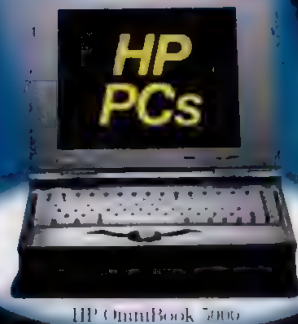
Call 1-800-443-1254, Ext. 367,† for more information. You'll find that good news travels fast.

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HP OmniBook 5000VL
*Desktop performance
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HP OmniBook 7000

*See page 4. U.S. street price. J.D. Power and Associates, 1995 Notebook Computer End-user Satisfaction Study. Office Based Businesses. Study conducted among 1,234 business users. Pentium and Intel Inside logo are U.S. registered trademarks of Intel Corporation. Microsoft Windows and the Windows logo are registered trademarks of Microsoft Corporation. © 1996 Hewlett-Packard Company. PPG428



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PACKARD**

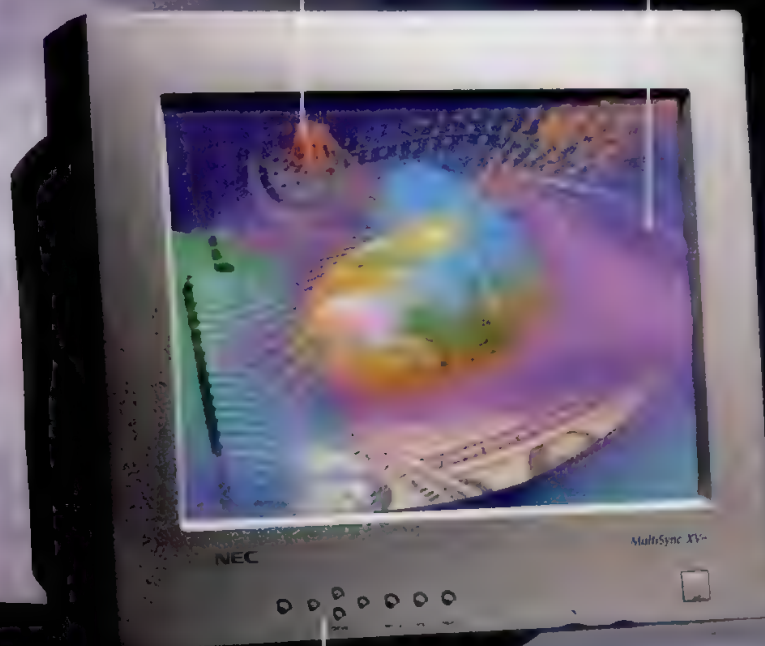
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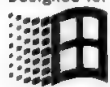
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Engineers: The Next Generation

Electrical engineers are an endangered species. We train fewer engineers than ever, while business and consumer products become increasingly complex. Engineering is, to my way of thinking, one of the best training grounds for programmers, because it

teaches what's going on at the device and component level, something that's often a mystery to computer scientists. Before the personal computer revolution, some computer science majors managed to graduate without ever having seen a computer. They were well-grounded in theory but sadly deficient in hands-on experience.

Back in the mid-1960s, when I was in high school, the sciences were taken far more seriously than they are today. President Kennedy had pointed us skyward, all the way to the moon, and engineers were the foot soldiers in the vast army that would get us there. In addition to the usual science courses, we had a multiyear electronics elective. Nominally an industrial arts course, it was a thinly disguised pre-engineering program, light on theory, heavy on intriguing hands-on experimentation that would capture its share of our teenage attention spans.

It worked. I'm still an electronics hobbyist, and what I learned was the foundation of my computer-oriented career. Today, this program and its kind are nowhere to be found, victims of shrinking school budgets and the progressive views of our New Jersey education commissioner.

All is not lost, however. If you think your child may be interested in electronics, your PC can help. "Fun With Electronics," a new CD-ROM title from Philips Electronics, does a superb job of initiating everyone from eight-year-olds to adults into the mysteries of circuits and components. This \$44.99 CD-ROM comes with a little workbench that holds the components and the wires to connect them in spring clips. You'll forgive the packaging's boast of 100 electronic parts—they must have been counting the pieces of wire—but the 25 or so components make for a wide variety of experiments and interesting projects. The whole thing is powered by a 9-volt battery and resembles an update to Radio Shack's venerable 150-in-1 electronics kit.

The CD-ROM is well done, with lively graphics, sound, and video movies. It takes you step by step through the process of setting up the workbench. It took Andrew (my ten-year-old son) and I half an hour of chatty, unpressured

mutual effort. Along the way, the CD-ROM introduces us to the cast of characters. The Transistor Sisters tell us how they work to a lively rap beat. The grumpy, overworked resistors complain good-naturedly that they're underappreciated. Way-cool LEDs wear shades and are always headed for the

beach, dude. And so on, until we've met all the components. Their explanations of what they do are simple, clear, and accurate. Andrew, no stranger to a soldering iron, learned a few things.

Next, we picked a project (they're grouped by difficulty), and the program showed us exactly where to connect each wire. It told us what the circuit should do and how to check it if it doesn't work. None of the projects took more than a few minutes to set up, so there's little chance for boredom to set in.

The projects themselves are likely to engage a young mind: flashing lights, sirens, sound effects, radios. Better still, the component characters interject comments as they direct you to hook them up. Everything Andrew has built so far has worked the first time with the exception of the transistor radio. That's one of the most complex circuits, and I wasn't there when he built it, so we'll revisit it.

After you've played with the circuit on the workbench for a while, you go back to the CD-ROM, which shows you a snippet of an old silent movie, a comic riff on the uses or misuses of the circuit you've just built. Then it goes on to explain in clear, direct terms exactly how the circuit works,

using an on-screen circuit diagram and animation that illustrates the flow of electricity and the actions of the components. You can print out the instructions, but we haven't discovered a way to print the circuit diagram, which would be handy for studying the circuit.

Fun With Electronics may not single-handedly rescue the U.S. from its current antitechnical swing, but it's the best thing I've seen to get young, open minds familiar with the inner workings of the devices that so utterly dominate their—and our—lives. I hope we'll see follow-on products that use simple microprocessors and other, more sophisticated components in the same, clear, building-block fashion. □



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CIRCLE 203 ON READER SERVICE CARD

PC Bloopers '96

I haven't done a PC Bloopers column for a few years and felt it was a bit overdue. These are some of the crazy mistakes newcomers make when they first get their computers. I don't tell these stories to humiliate newbies, but to point out how poorly we communicate

about technology and how important it is to understand something about how these machines actually work.

There has always been a debate as to exactly how much of an appliance a personal computer actually is. I believe we are still far away from that ideal. As more amateurs come on board, entranced by all the Internet hype, more weird and crazy stories will emerge.

The typical crazy mistakes I've discussed in the past include the oft-told story about the person waving the mouse in the air or using it as a foot pedal. There are also the ones about the disk stapled to a letter or placed on the refrigerator with a magnet. I solicited a couple of folklore newsgroups to find some new stories, and the following are a few of the best.

Phil Rose tells this tale: Some years ago a leading U.K. furniture manufacturer decided to have its factories computerized. As part of the plan, a networked PC was installed into the Goods Inward department. The department was a one-man operation, and the company accountant, who was helping with the staff training for the new system, went to show the employee how to operate the new hardware.

"You see," he proudly said, holding up a sheaf of Goods Inward notes, "instead of entering these in the book and keeping track of the figures manually, you put them directly in the computer, and it will do it all for you." He went on to expound on the benefits of the computer for several minutes.

The employee listened patiently while staring at his new PC. Eventually, after much head scratching, he replied, "Well, what you say about it making my job easier may well be true, but I'm going to have a hell of a job folding up these Goods Inward forms small enough to post them in that little slot on the front."

Another incredible tale comes from Larry Groebe of CompUSA who described how a new user was repeatedly pressing the F1 key to summon help. After a while, she became indignant at how long it took for someone from the company's help desk to show up at her workstation to answer her question. People simply expect too much from

these machines.

Here's a memorable anecdote from Alicia Dana: A man called in to customer service and said his computer was not working. After going through the usual list, the customer service rep asked if the computer was plugged in. The customer said, "Hold on, I'll go get a flashlight."

The rep said, "Why do you need a flashlight?"

The customer replied, "Because it's dark in here. The power is out." When told the computer would not work without power, the customer was outraged and said he was told that he had purchased a computer with "backup" (a tape-backup archiving system). You know, reading the manual sometimes helps.

George Gonzalez writes: One woman called a customer service number and said she always got a busy signal when her computer called the modem pool. She kept on calling and calling, complaining about busy signals. Finally, we decided to clue her in on an experimental phone number that pointed to a few new-at-the-time 14.4-Kbps modems. But she insisted, 'No, I can't put in that number; I have to put in my home number.' No amount of reason could get her to understand that the computer at her home had to call the number of the modem at her service provider. Last we heard, she remained unconvinced, calling herself and complaining about the busy signals.

Finally, the absolute classic of the year, courtesy of Silas Warner: "Hello, ESM tech support." (The company name has been changed to protect the author.)

"I've got to stop this before my computer is ruined."

"What seems to be the problem, Miss?"

"Well, I put your demo disk in the slot. And I typed 'A' and the colon. And then I put down 'PKUNZIP DEMO.ZIP C:' like it says on the label."

"Yes."

"And now something in my computer is *exploding!*"

Hint for those unfamiliar with the operation of PKUnzip as it decompresses the files: It sometimes reads "Exploding Filename."



USER-FRIENDLY?

There's always been debate over how much of an appliance a PC really is; it's still far from ideal.

Turning the stereo up

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Tasting frosting

Learning about fire

Dental spinach extraction

Calling a friend

Popping open a brewski

Reading big words

Un-waxing your ears

Re-winding cassette tapes

Shaking hands with infants

Channel surfing

Scratching between your shoulders

Clearing your nasal passage

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Inside Track

Rumors abound that Microsoft is going to **split into pieces** and go in all sorts of different directions. Note its recent partnering with NBC and its intent to do a 24-hour news channel. What's that all about? Also, Gates has been collecting the electronic rights for everything he can get his hands on. What's that all about?

The latest twist in this soap opera is that Microsoft is about to **change its marketing** strategy concerning Windows. Well, maybe *change* is the wrong word, since I believe this has been the plan all along. Essentially Microsoft will break its business division away from its consumer division and sell Windows 95 in the consumer market. It will also bring

Windows NT onto the business and professional desktop in a big way. You can see this coming with Microsoft's Plus Pak for Windows 95, full of **pinball games and wacky screens**. None of it is appropriate for business.

I first noticed this trend before Windows 95 was even launched. It was apparent that it was a consumer product, not a business product, and I made the comment that it could be the most **successful** consumer product Microsoft has ever done. I stressed the word *consumer*. A Microsoft person asked me if the company could use the quote for some presentation it was doing, indicating that I was on to something. Then, of course, there was the evidence that Microsoft itself was **telling corporations to think** in terms of Windows NT—not Windows 95—for their desktops.

What does all this mean to you and me? Does it mean the typical *PC Magazine* power user should be going to Windows NT soon? Does it mean that Windows 95 is a dog? Why should we have to choose between two different operating systems from the same company? **Can't it just make one good one?** I can understand how some people may become confused.

I believe that Windows 95 will become the **dumb** operating system for the masses, and Windows NT will be the **smart** operating system for the power users. I also believe that such a strategy is destined to fail. This is because there will eventually be some piece of code that utilizes some special feature in one of the two operating systems, in such a way that it will be a **compelling killer app** requiring everyone to use that operating system, whether for home or business. The other OS will die during this phase.

Sleek New Machines Dept. If you saw the movie *Sabrina* released at the end of 1995, you saw the Apple Spar-tacus computer on Harrison Ford's desk. **This secret machine** was allowed to be used as part of a prepublicity stunt, which was noticed by only a few trade magazines. Apple believes that an LCD-based desktop computer is the comput-

*Why should we have
to choose between
two different operating
systems from the
same company? Can't it
just make one good one?*

*I can understand
how some people
may be confused.*

ing future for executives and yuppies alike. Unfortunately, in a Windowing environment, you need screen real estate, and the 21-inch or even **26-inch screen** is what users prefer when given a choice. We won't be seeing commercial 21-inch LCDs anytime soon. But Apple has stumbled onto a sleek new design.

It has taken longer than anticipated, but new computers from companies such as **Acer** and the **Panda Project** are implementing sleek new designs that other makers will have to adopt. The days of the beige box are ending. In Boca Raton, Florida, a group of ex-IBMers, among others, have developed what may be the best looking machine ever designed. Also, the Panda Project is the first serious **back-plane machine** I've seen since

the invention of the PC itself. I'd guess that this modular machine will actually last a decade or more and be seriously upgradeable during its entire life. By seriously upgradeable, I mean it can be **completely upgraded** to a totally new computer (not just chip-upgraded), to give it a few extra months of life. Check these guys out. The machine is cool-looking.

But whether it's as radical-looking as the Acer is hard to say. The Aspire is so aerodynamic it looks as if it's **about to fly right off the desk**. And it comes in either emerald or charcoal. Designed by a firm called frogdesign, the Aspire was one of the finalists in *PC Magazine's* Technical Excellence Awards (December 19, 1995), where editors described the vent holes in the minitower as looking like they were made by **a couple of shotgun blasts. Wild.**

Despite the fact that Apple and the Panda Project have been promoting new case designs, the real action has been in Taiwan. Note that **Taiwan leads the world in plastics technology**, especially injection molding. Many of the most complicated designs can be done only by the Taiwanese plastic engineers. Also, the Taiwanese have been trying to **promote more colorful machines** with little success.

I've harped on this color issue for years, and it amazes me that the American market actually shows resistance to a blue or purple computer. I even get **angry letters** telling me that I should be discussing chip technology rather than color schemes. Why we have become so uptight mystifies me. Anyway, buy better looking machines.

Genuinely Interesting Software Dept. Are you thinking of dabbling with Web design and the Internet? Well, you need an HTML editor of some sort, and the **definitive** editor is HTML Assistant Pro 2 from Brooklyn North Software Works in Bedford, Nova Scotia (902-493-6080; fax, 902-835-2600). This \$99 wonder is used by most of the professionals and is considered the standard HTML editor **by which all others are judged**. Highly recommended. Buy it. □

So you thought you'd save a little money on your memory.



Great idea. After all, memory upgrades can be a very costly addition to your system. And with the demands new software is placing on your PC these days, virtually everyone who uses a computer eventually buys more memory. One little detail is often overlooked. Many companies sell memory upgrades manufactured with DRAM that does not meet the correct industry standard voltage range for your system. The resulting voltage loss can cause you to lose valuable data. Sub-spec memory runs too slow to match the speed of newer, faster processors, causing timing errors that can corrupt your hard drive and even leave your system inoperable. So cheaper memory might cost less in the short run, but you get burned in the end. To avoid these problems check your system's manual for correct refresh rates, speed and voltage specs, and make sure you install memory that matches it. Or, easier yet, just buy Viking Components memory. It's the best.



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CIRCLE 239 ON READER SERVICE CARD

The Evolved Web...Someday

Spend a lot of time on the Web? Me too. Like everything you find? Me neither. For all its joys, the Web has a lot of frustrations: Messy searching, Web sites that mysteriously disappear, tough-to-strip and embedded HTML code, security worries,

and more. Yet we return again and again because the Web is so damned compelling. When it works, it really *works*.

Two terms making the rounds with Web mavens these days help put the problems in perspective. The first is Web Years, a concept analogous to dog years. If one dog year equals seven human years, how many years of Web life equal a year of human life? I'd say it's about a ten-to-one ratio right now—and increasing. The growth of the Web has been so fast—and at a rate that continues to accelerate—that absorbing the evolution of the Web is incredibly difficult.

This leads us to the second term, the Evolved Web. This one's based on the view that the Web today is only a tiny fraction (and perhaps not even a representative one) of what it will someday become. The Web will eventually achieve maturity—a term hard to apply to the Web today, at least with a straight face—and looking back, we'll marvel at what we put up with way back in 1996.

We could define a long list of problem areas for Web users, but three I find interesting are what I've been calling in my speeches "The Three S's": Searching, Saving, and Security.

SEARCHING...

A year ago, searching the Web was a task for the trained professional. Today, we're inundated by Web search tools for the casual user. In less than two years' time, companies like Yahoo have emerged from the vapor of the Web, offering rich (if not terribly varied) ways of searching. In addition to Yahoo, I use Lycos, Web Crawler, OpenText, and other search tools. But too often, the hit lists I get are either overlong (Lycos), burying me with information, or short but quirky (Yahoo), sending me on wild-goose chases that are fun but incredibly time-wasting. Sure, I sometimes want serendipitous discoveries; usually, however, I want something specific *right now*.

The next step in Web search engines—contextual searching—is already here in the form of Excite, Architect's whole-Web search engine that finally shipped in October 1995. By mid-December, it was running in site-spe-

cific form on about 500 Web sites, two-thirds of them public and one-third of them private "Intranets." Excite offers more promise than any of the other context-oriented search products I've seen.

The local-server form, Excite for Web Servers, maps the contents of individual Web sites, looking for themes and what we might loosely call ideas. When you search within those sites, Excite finds clusters of related information on the topic you really want, even if your search word or phrase was sloppy. It then helps you to drill down quickly through those information clusters. And Excite produces the most civilized and literate abstracts I've seen.

Excite is already running on a lot of high-profile Web sites for local indexing—Netscape, Sega America, and Wired magazine, among others—and it seems headed for major successes. Visit <http://excite.com/> for more information. Excite is also free; you can get it for your site at <http://excite.com/navigate>, which also has a list of great sites already using the engine.

Clearly, the Evolved Web will rely on a product similar to this. We'll get there in maybe another 20 Web Years. Computer doyenne Esther Dyson once coined a term for her preferred computer interface: DWIM, or Do What I Mean. We need Web searchers with FWIM: Find What I Mean.

SAVING...

So what do you *do* with the stuff you find on Web pages? You can scroll up and down, jump from one page to another, and then, when you find what you want, you can save that source document and...start gnashing your teeth. Because when you open it with your word processor, planning to read, format, and *use* it, you have this terrible, unreadable page filled with HTML commands. It can take five times as long to scrape your way through that document, cleaning out the junk, as it did to find and download it.

Why, oh why, can't browsers have a Save Source Doc command that asks us in which word processor's native file format we'd like our documents saved? This isn't rocket sci-



AGING PROCESS

The Web will eventually mature, and we'll marvel at what we put up with way back in 1996.

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CIRCLE 080 ON READER SERVICE CARD

JIM SEYMOUR

ence: OCR programs, format-conversion programs, and other apps do it routinely. The browser developers, flush with IPO cash, could license the "technology" to save incoming HTML-formatted text in the three word-processor formats that count: Word for Windows, AmiPro/WordPro, and WordPerfect for Windows. How much? Maybe \$50,000, tops—chump change for them. Makes you wonder if they ever *use* the stuff they browse, doesn't it?

Someday, Evolved Web browsers will allow you to grab text and graphics effortlessly for use directly in your apps. Just a few more Web Years, I hope. (Tip: Until then, use Paul Bonner's WordPower macro for WinWord to strip most HTML code; ZD Net members can get it free from the ZD Net CompuServe Edition's Software Center.)

SECURITY...

Ah, yes. The security issue. It's hard to pick up a newspaper nowadays without seeing another story about how the Web is teetering on the edge of collapse because two college students at a Sun workstation just ripped open the Web's burglar bars. The sky is falling, and so on. Put away your credit cards and close your Netcom account; the Web's going under.

I often wonder if the reporters who write these stories—or you and I, since our eager consumption of this claptrap is what keeps it coming—have ever eaten in restaurants and paid with a credit card. You give a waitperson your credit card, and he or she disappears. A few minutes later, he reappears with your card, your bill, and a credit card form to sign. You sign, pocket the card, and leave. Only later do you find that he ran a second charge through while he had your card. Or kept the carbons from your charge form. Credit card fraud doesn't arise from manic hackers trying to intercept credit card numbers flying back and forth on the Web. Credit card fraud arises from the knavery of ordinary people—something that will never change.

Sure, getting Web security right is important, and ultimately the Evolved Web *will* get it right—in another 30 or 40 Web Years. For now, if you're nervous about entering your credit card details in a browser's form, just call the 800 number that appears next to that form and give them the data that way—exactly as you do when buying by phone today.

The more I use the Web, the more I realize how shallow, tentative, and primitive it really is. That'll change: Just let it evolve a few more Web Years. □



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Accessorizing Your PC

Vendors of PC add-ons live for those effusive plugs from reviewers and columnists: "The handiest utility I've ever used. Can't live without it." "An indispensable part of any PC user's arsenal of tools." Of course, the truth is that none of these prod-

ucts are really *indispensable*. I mean, you've lived just fine up until now without the quintessential mouse pad. But there are plenty of good accessories that make computing easier and more productive. Here's a look at a half-dozen interesting products I've recently used and, for the most part, like.

Mouse Pad I. You probably have a couple of mouse pads already, freebies from your PC maker or local dealer. Here's one worth paying for: the 3M Precise Mousing Surface. It's a grippy, "microreplicated" surface (made from a 3M miracle plastic coating) that helps even gummed-up mice track straight and true, and it's ultrathin, so there's no uncomfortable edge. Nitpicks: The pad is a bit small (7 by 8 inches), and the name doesn't exactly roll off the tongue (\$15; 800-697-5423, <http://www.mmm.com>).

Mouse Pad II. Everyone around the office who saw the Rubbermaid Expressions mouse pad loved it. You can slide an 8- by 10-inch photo under the clear, lift-up surface. Great idea? Not so fast: The rippled surface is slippery and doesn't allow for precise movements with some mice. If Rubbermaid could apply the 3M coating, you'd have a winner (\$10.95; 800-827-5055, <http://www.rubbermaid.com>).

Twofer Modem Switch. If you normally have your modem attached to line 2 in your home office, but you want to use it occasionally on line 1, get Radio Shack's two-way phone-line switch. While it's intended for the connection of two devices to one phone line, I find it more useful when used the other way around, with one device (my modem) connected to one of two phone lines (\$14.99; 800-843-7422, <http://www.tandy.com>).

Multimedia Speaker Controls. The same people who design the tiny, slick buttons on car radios apparently design those teeny multimedia loudspeaker controls, too. And often the speakers are hidden behind a pencil jar, a desk lamp, and a soda can. All of which conspire to keep you from turning down the volume Right Bloody Now when some app outputs sound 10 dB louder than you expected. Get hold of the optional volume control from Cambridge

SoundWorks. This control, which comes in beige or black, is the size of a pack of gum. It adheres to the side of your PC or monitor and takes the place of the cord running from your PC sound board's line-out jack to your speaker's line-in jack (\$12.99; 800-367-4434, <http://www.hifi.com>).

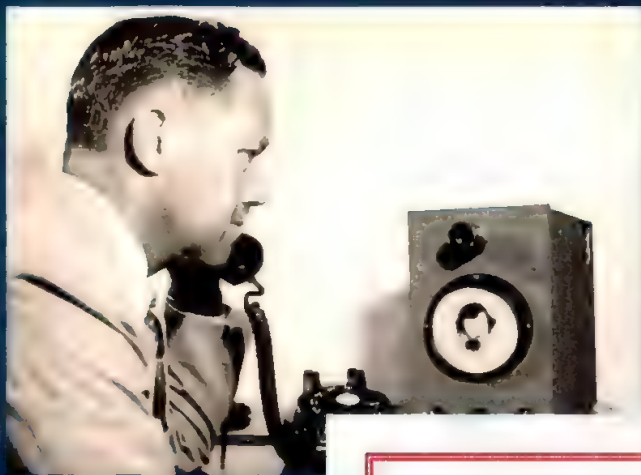
Memo to Microsoft: Please don't bother sending e-mail claiming the Windows 95 taskbar has a mute button and volume control. Not so. It has a speaker button that provides access to the mute button and volume. There's a difference. I count six steps required to silence the speakers: Move hand to mouse, slide mouse pointer to speaker icon, click icon, wait for dialog box to pop up (one, one thousand, two, one thousand. . .), slide mouse to mute check-box, click.

Computer Telephone. What a neat idea: A famous maker builds a two-line, caller-ID telephone with a serial port that can transmit details on incoming calls to any TAPI-compliant application running on your PC or to an included call-log and phone-directory program. How could it miss for a small office doing time or call billing? Well, maybe if your PC doesn't have any free serial ports. The AT&T Computer Telephone 8130 was probably a year ahead of its time and might have been a smash success if it had been equipped with a universal serial bus (USB) connector instead. For better or worse, AT&T is phasing out this brand-new phone (\$200; 800-233-2650, <http://www.att.com>).

Finally, three other products deserve mention, even though much has already been written about them. Let me add to it: They're great. TView's (formerly Consumer Technology Northwest) Presenter Tview is a "scan converter" that lets you run a PC presentation, or Hexen, on a big-screen television (\$400 street price; 800-356-3940, <http://www.tvview.com>). Play Inc.'s Snappy video frame grabber captures snapshots from TV and videotapes (\$200 street price; 800-306-7529, <http://www.play.com>). And the third product is the Visioneer PaperPort Vx personal document scanner (\$369 street price; 800-787-7007, <http://www.visioneer.com>). □



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NETWORK EDITION

NETWORK BACKUP

Backup to the Future

So you've got a Windows NT server or two on your network. It may be time to use them for other duties, such as backup.



By Steve Rigney

This isn't just a NetWare world anymore. Microsoft Windows NT Server is quickly becoming a favorite operating system for applications servers. Keeping Windows NT servers safe and being able to restore them in emergency situations have become high priorities for network administrators.

It's no surprise that Windows NT has become so popular.

INSIDE



We've known it was coming. And now it's here. A significant swell in the number of third-party enhancement products for Windows NT Server is upon us, promising a bona fide wave before long. It's a wave that will wash out Novell's grace period.

NETWORK MAY CONTINUE to have the greater number of supporting products for some time. But our cover story proves that Windows NT earns the attention of market leaders that many network managers want to hear about. Moreover, these network-backup products are a good fit with the applications server duty many Windows NT systems see.

TWO OF OUR CONTRIBUTING editors team up to report on these first network-backup products that do their thing from a Windows NT base. Steve Rigney and Tony Pompili put packages from Cheyenne Software, Palindrome Corp., and Arcada Software through the hoops at PC Magazine Labs, West Coast. The authors say these are solid backup solutions for your Windows NT server.

IN FIRST LOOKS, JEFF WITT, the project leader on our networking team, reports on the latest exciting movements on the Fast Ethernet front. Cogent's most recent products adhere to the IEEE 802.3u 100Base-T4 standard, which means you can use them to run 100-Mbps Fast Ethernet over your Cat 3 UTP. Witt gives them the thumbs up. (Page NE43.)

ISDN CONTINUES to grow in popularity. Author Les Freed reviews a terrific new version of BitSurfr Pro. We're seeing a nice dovetail in the ease of securing the service with the appearance of more good ISDN products. (Page NE47.)

THE TRUTH IS OUT THERE. If you agree, check out West Coast PC Labs director Steve Buehler's latest Multiple Access. (Page NE55.)

—Gail Shaffer

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JANUARY, 1996
P133 POWERSERVER SMP



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- PCI 64-bit video, MPEG, 2MB EDO
- Full-size tower with 10 drive bays
- Microsoft® Mouse, 104-key keyboard
- Microsoft Windows® 95 CD
- 5-year/3-year Micron PowerSM warranty*



JANUARY, 1996
P133 POWER SERVER SMP

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POWER SERVER SMP P266

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- 512K write-back cache, flash BIOS
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- PCI 32-bit Ultra SCSI Fast-20 controller
- 6X SCSI-2 CD-ROM drive, 3.5" floppy drive
- PCI 64-bit video, MPEG, 2MB EDO
- Full-size tower with 10 drive bays
- Microsoft Mouse, 104-key keyboard
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Unlike NetWare, Windows NT is a true multithreaded, multitasking OS. It is also a fast base for running applications server programs, it virtually never crashes, and it has powerful security features.

The next logical step after installing an OS is making sure you can back it up. Here, despite its strengths, Windows NT simply can't stand on its own. Although Microsoft Corp. and Arcada Software have written a native backup utility that's included in the box, this utility doesn't have scheduling or reporting capabilities. What's more, it can't work with many hardware types, and it doesn't include agents for some specific platforms.

Fortunately, three companies now offer backup programs that run on Windows NT. In this roundup, we review Cheyenne Software's ARCserve for Windows NT, Palindrome Corp.'s Backup Director, and Arcada Software's Backup Exec for Windows NT, all of which are designed to protect server-based applications and data over your entire LAN. These new programs take care of what's missing in the Windows NT utility.

Each product offers an intuitive interface and is fairly easy to set up and use. More important, each performed our basic backup and restore jobs without a hitch.

The packages differ from one another, however, when it comes to performance and compatibility issues. If you need to back up different operating systems and platforms, you should consider Backup Director or ARCserve for their cross-platform talents. Backup Director is the best choice if you also want powerful scheduling and tape-rotation features.

BACKUP BENEFITS

You pick up several benefits by running your backup from a Windows NT server (rather than from NetWare). For one thing, Windows NT has stronger backup server security; NetWare doesn't yet provide the same level C2 security. Also, Windows NT is less likely to crash: Everyone knows that a bad app can bring a NetWare server to its knees, but that same app won't touch a Windows NT server. Last but certainly not least, as a popular applications server platform, Windows NT is likely to house some of your mission-critical apps. It just makes sense to have backup on the server where the apps reside.

Unlike the backup utility bundled in Windows NT Server, all of the products here run as 32-bit Windows NT system services, not as applications. Running your backups as a system service improves per-

Backup Director 4.0

With the simplest setup and most robust automation tools of the programs we tested, Backup Director has a clear edge over its competitors. Palindrome has really streamlined the backup

process in its product. It seems all you have to do is change the tapes.

Backup Director features unparalleled tape-rotation management and cross-platform tape-level compatibility, including support for the SDF tape format. Its built-in intelligence automatically distributes jobs across multiple tape drives.

The package can even provide the means to overcome operator errors. For example, if you forget to insert those nightly tapes, it attempts to use existing tapes for the backup, regardless of how they're labeled.

Cheyenne Software's ARCserve earns an honorable mention for its simple, straightforward interface. Among



the products we tested, it was the easiest to master and use. And because it is highly consistent with its NetWare predecessor, ARCserve is a natural choice if you're planning to migrate between NetWare and Windows NT operating environments.

Like Backup Director, ARCserve allows full NetWare backups from Windows NT servers. In addition, ARCserve Client Agents, like Backup Director's Connection Managers, can back up multiple servers simultaneously. ARCserve's local backup speed is impressive, but it does not hold that edge when it comes to network-based backup. It had the lowest throughput of the three when backing up remote Windows NT servers.

formance. It also lets you launch a scheduled job without logging on to the server—a nice feature in the unlikely case that your Windows NT server does crash, and no one is around to log back into the system when it revives.

A system service also eats up less memory than an application. That's because a system service in Windows NT is neither a driver nor a TSR. Instead, it is a small piece of code that runs on top of the Windows NT kernel when you turn the system on.

There is one caveat: Windows NT-based backup is a new technology, and these packages are not as mature as those for NetWare. The vendors we reviewed started out making backup products for NetWare and other platforms and have just begun to move into the Windows NT market. Thus, their Windows NT products do not take full advantage of the Windows NT OS (see the graphic "How Windows NT Handles Backup"). Only Backup Exec, for example, which was written expressly for the Windows NT platform, uses Windows NT's built-in tape drivers and works with the Microsoft Tape Format (MTF) standard. None of the three products work with the Event Logger or the built-in scheduler in Windows NT Services.

Before you purchase any of these prod-

ucts, you'll want to make sure it offers backup agents for all of the PCs you need to back up. You may also need to look for a product that can read the existing tapes of your current backup program; see the sidebar "Media Standards (Finally) Taking Shape."

THE AGENTS

One of the most important signatures of a good backup program is its ability to back up distributed clients and servers that are running on various operating systems and platforms. The program uses a *backup agent* residing on each client and server to do the backup.

Both ARCserve and Backup Director include agents for NetWare, but as of this writing, Backup Exec doesn't allow you to back up your NetWare servers. ARCserve uses a technology called a *push agent* to increase performance when you back up other remote servers and clients. The ARCserve agents use the target PC's CPU to push the data to the backup server (unlike most agents, which use the backup server's CPU to pull the data off the target PC). We did not, however, see a big improvement in performance when we tested the ARCserve push agents against the agents that come with the other products.

In some cases, agents are integrated

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	Power Object	Visual Basic
Drag-and-drop database programming	Yes	No
Integrated SQL database	Yes	Yes
Industry standard BASIC language	Yes	Yes
Seamless scalability to Oracle™ & SQL Server	Yes	No
Native Oracle™ & SQL Server interfaces	Yes*	No
True object-oriented code reusability	Yes	No
OCX and OLE 2 support	Yes	Yes
Multiplatform: Windows, Macintosh, OS/2**	Yes	No

* Supports both Oracle and SQL Server.

** Standard OS/2 support available.



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with a desktop or network OS. For example, Windows 95 comes with 32-bit backup agents for ARCserve and Backup Exec. But right now, the ARCserve Windows 95 agent works only with the ARCserve NetWare package, and the Backup Exec Windows 95 agent doesn't work with either NetWare or Windows NT. Backup Exec does offer a Windows 95 agent that works with the Windows NT version of the product, but you have to download it from Arcada's BBS.

CHECK YOUR SCHEDULE

Most administrators don't like to perform a backup during working hours, so being able to schedule and automate after-hours backups is quite important. Fortunately, all of the products in this roundup let you set up your backups to run at any time of the day. You can also schedule recurring backups that run every day or once a week.

You will probably want to use a different tape for each day of the week—if not more. Each product here lets you use different tapes, but only Backup Director currently includes built-in tape-rotation features, including both the Grandfather-Father-Son (GFS) and Tower of Hanoi schemes. If you want to perform the same types of rotations with the other products,

you'll have to keep track of all of your tapes manually.

DRIVING THE HARDWARE

Windows NT comes with a set of tape drivers for most SCSI backup devices, including 4-mm DAT, QIC, and DLT. The developers at Arcada helped Microsoft write these drivers, and Arcada is the only vendor in this roundup that uses them.

Backup Director includes its own proprietary drivers, and ARCserve doesn't require drivers. Instead of using tape-device drivers, ARCserve actually scans your SCSI bus to see what devices are attached. It uses the firmware information in the device to perform the backups and restores.

ARCserve also works with the mini-port SCSI drivers that come with devices that use the Plug and Play standard. Because it doesn't use drivers, ARCserve is especially easy to install, and it works with almost any vendor's tape-backup device. All three vendors also offer an autoloader driver, but only as a module that you have to purchase separately.

ALL THINGS BEING ABOUT EQUAL

Speaking strictly in terms of performance, there was no clear winner among the three products. ARCserve had the best numbers

when we performed a local backup but came in last when we used the product to back up a remote PC. Backup Director required the least amount of time to start a backup job and also provided the best times for remote backup operations.

If you have several PCs that you need to back up to different devices, strong performance might not be enough. Instead, you should look for the capability to back up different resources to different devices simultaneously. You'll find this capability in both ARCserve and Backup Director.

Backup Exec will let you run multiple jobs, but instead of running each job as a different application thread, it forces you to run multiple instances of the entire program. This eats up memory on the server and can slow performance.

None of the products currently let you stripe a single backup job across multiple devices. Developers at Cheyenne, however, are working on a product called RAID FT, which will let you back up a single job to multiple devices, saving valuable time.

If you rely on unattended backups to protect your data, you need to know that those jobs have been completed without any errors. If you are not around, the only way to check a backup is to view a log file or to scan the contents of the backup tape. All three products offer a variety of canned reports. You can view the reports on the screen, save them to a file, or print them out. In addition to viewing a standard job log, you can view history reports on all of your jobs, even keeping track of which tapes and drives you used for a particular backup.

We're just beginning to see Windows NT backup server software, along with other, brand-new, third-party packages that aren't merely ports of NetWare predecessors. Keep reading to see how these young packages measure up.

Cheyenne Software Inc.

ARCserve 2.01 for Windows NT, Enterprise Edition

ALL REVIEWS BY TONY POMPILI

As is usually the case with new developments, the leaders in the field deserve a serious look—especially when you're dealing with an operation as critical as backup. Cheyenne Software's ARCserve 2.01 for Windows NT, Enterprise Edition, combines snappy local backup performance, support for good old NetWare, and ease of use in a commendable product. Other pluses—such as on-the-fly

NETWORK BACKUP

How to Read the Suitability to Task Boxes

SUITABILITY TO TASK

Product name

Installation and configuration	Poor
Management and administration	Excellent
Compatibility	Poor

When you're making the jump to a Windows NT-based backup system, you want as smooth a transition as possible. Our Suitability to Task ratings reflect how easily the packages here will fit into your backup environment.

Installation and configuration refers to how easily a product can be taken from the box and installed on backup servers. Client agent installation is part of this rating. We consider documentation and installation

programs, and note how easy it is to interface with our existing tape drive. Products also are judged on how complicated they are to configure and fine-tune once installed. This includes setting up tape management and scheduling.

Management and administration ratings are based on a product's logging and error reporting, its alert options, and its ability to recover from system or operator errors. Ratings also reflect how effectively backup monitoring tools provide real-time backup status information for both the backup server and the client. Because the ultimate objective is to be able to restore files, we also look at each product's ability to locate and restore files as well as to perform disaster recovery on crashed servers.

Compatibility ratings reflect a product's ability to work with key components in an existing backup system. To earn an *excellent* rating, a product must be able to perform complete backups of data and system files for a number of client and server types. We also consider how well the backup software works with tapes generated on other backup systems. These could be tapes from another product in the backup vendor's line or tapes from a different vendor altogether.

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SUMMARY OF FEATURES

Network Backup

■ YES □ NO

Products listed in alphabetical order

List price

Client Backup

Windows NT 3.5x Workstation/Server

NetWare Server 3.x and 4.x

DOS/Windows/Windows 95 NetWare clients

Macintosh

OS/2, Unix

Microsoft SQL Server/Oracle Server

Tape Formats Supported

SIDF/Microsoft Tape Format

ARCserve 4.x and 5.x

Maynard/SyTos

Tape-Rotation Systems Supported

Grandfather-father-son (GFS)/Tower of Hanoi

Custom

General Features

Performs attended and unattended backup

Retries open files

Checks for viruses

Interleaves multiple clients on a single tape

Requires Windows NT client agents on backed-up computers

Performs parallel streaming of backup jobs

Performs backup using Windows NT administrator shares

Performs automatic load balancing among tape devices

Supports Registry backup at the hive level

1 This client requires a NetWare server. 2 ARCserve can use either optional client agents or Windows NT share.

virus-checking—provide security for your all-important system and data files.

Like the other two products reviewed here, ARCserve can back up and restore FAT, HPFS, and NTFS file systems. It writes to SCSI miniports and works with most of the popular tape drives and adapters. The package keeps a local copy of tape catalogs, making it easy to locate files to be restored. An optional Auto-changer module is \$595.

ARCserve's installation was the most user-friendly we saw. Like its competition, ARCserve installs as Windows NT Services and can back up local or network-connected Windows NT clients and servers. It uses administrative shares provided by either Windows NT or ARCserve Client Agents.

These agents make it possible to back up important Windows NT files such as the Registry, system files, and the events log. They also communicate with the backup server over IP or IPX, using Cheyenne's

tried-and-true push technology. The push technology transfers control of the backup to the Windows NT server or client being backed up. This frees up normally busy ARCserve backup Windows NT machines.

Cheyenne's roots are in NetWare, and much of ARCserve's architecture and management maps neatly onto the Windows NT product line—and back. Windows NT machines running the ARCserve Client Agent can be backed up by either ARCserve for Windows NT or ARCserve for NetWare.

Working in the

PC MAGAZINE
NETWORK EDITION
EDITORS' CHOICE

Cheyenne
Software Inc.
ARCserve 2.0i
for Windows
NT, Enterprise
Edition

Palindrome
Corp.
Backup
Director 4.0,
Windows
NT Edition

Arcada
Software
Backup Exec
for Windows
NT, Enterprise
Edition 6.0

Multiserver,
\$1,395;
single server,
\$795

Multiserver,
\$1,595;
single server,
\$995

Multiserver,
\$1,295;
single server,
\$695

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SUITABILITY TO TASK

ARCserve for
Windows NT

Installation and configuration	Excellent
Management and administration	Good
Compatibility	Good



A BREEZE TO PICK UP: ARCserve proved to be the most user-friendly backup package we tested.

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Key#98596



BENCHMARK TESTS

Network Backup



During testing we found significant differences between local and remote backup times for each of the three products. Backup Director's superior remote-backup performance—an outgrowth of its agent technology—gave it an edge.

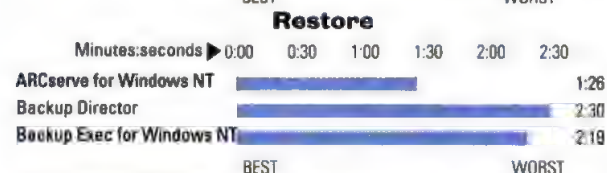
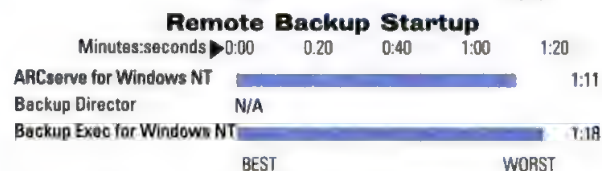
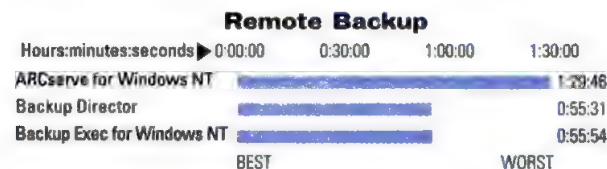
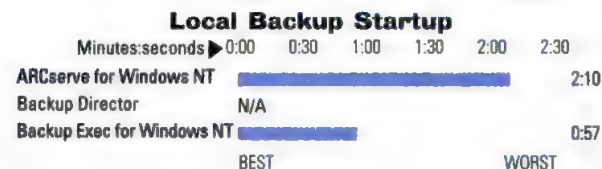
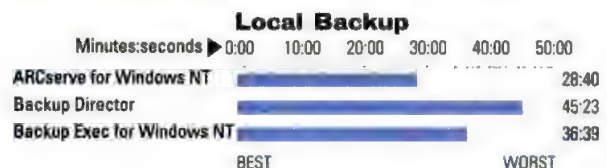
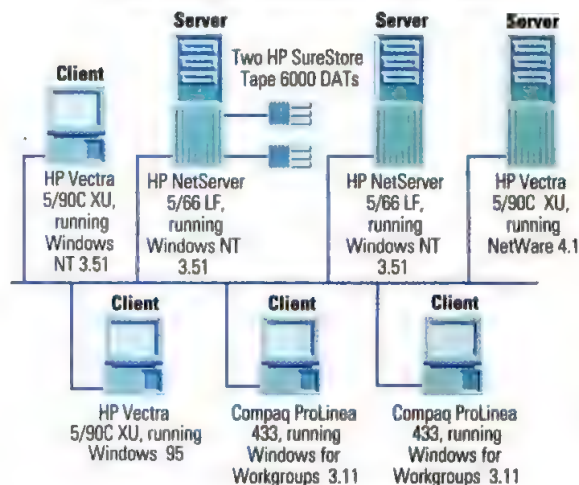
What the Numbers Mean

We aimed to measure the speed with which the reviewed products backed up and restored data files. On the backup side, we looked for raw throughput. The test files to be backed up, which included text, Microsoft Excel application and data files, Microsoft Word application and data files, and .PCX graph-

ics files, ranged in size from 100 bytes to 5MB. The total size of the combined files was 978MB.

We designed the **Local Backup** test to measure raw throughput while performing full, uncompressed backups. The server being backed up held the backup software and had the HP SureStore Tape 6000 DAT drives attached

Network Backup Test-Bed



N/A—Not applicable: Backup Director's database architecture makes filenames and addresses available immediately.

locally. We measured times from the point the backup began until the software indicated that the backup was complete.

Local Backup Startup scores indicate the amount of time it took each product to accumulate lists of files to be backed up and prepare the tape drive. Backup Director uses its rich database architecture to deduce backup start-up times to zero.

The **Remote Backup** test measured the throughput of files being backed up from a remote network-attached Windows NT server. The files were identical to those we used for the Local Backup test, except that they were installed on the remote Windows NT server.

The **Remote Backup Startup** results indicate completion time of any processes run by the program before the backup actually begins.

We used the **Restore** test to show the time necessary for each product to locate files on tape and restore them to a designated directory. We selected three files, one distributed at the beginning, one at the middle, and one at the end of the backup session. Restoration tests were based on how long it took for files to be physically restored. The tests' beginning

points were measured from the time the restoration request started processing from the software's job queue.

How We Tested

We tested the Windows NT backup products at PC Magazine Labs, West Coast. Our test-bed consisted of two HP NetServer 5/66 LF PCs, each with a 66-MHz processor, 32MB of RAM, and a 4GB hard disk, running Microsoft Windows NT 3.51. The Windows NT hard disks were configured for NTFS.

Each NetServer included an on-board, dual-channel Adaptec AHA-2742 EISA adapter. We used the Adaptec to connect our two HP SureStore Tape 6000 DAT drives. We ran the tests over a single Ethernet segment.

We also included a NetWare 4.1 server, which ran on an HP Vectra 5/90C XU with 16MB of RAM. In addition, we had one Windows NT 3.51 client running on a Vectra, two Windows for Workgroups 3.11 clients running on Compaq ProLinea 4/33s, and a Windows 95 client running on a Vectra. We tested end-user client agents on these machines.—*Analysis written by Tony Pompili*

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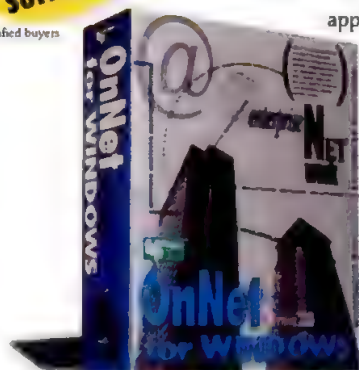
TAKE THIS AD WITH YOU WHEN YOU SHOP FOR TCP/IP.

COMPARE	OnNet for Windows 2.0	ChameleonNFS v4.5	LAN Workplace 5.0
Supports multiple Windows platforms with a single product (Windows® 95, Windows NT®, Windows® 3.1, Windows™ for Workgroups)	YES	NO	NO
Intelligent installation (user selects which features and network protocols to install)	YES	NO	NO
32-bit Windows-based VxD kernel for high performance TCP/IP	YES	NO	NO
Integrated multi-format document viewer and image viewer/converter (KEYview)	YES	NO	NO
An efficient and secure IP Serial to LAN switching capability	YES	NO	NO
Extensive support for diverse network infrastructures (X.25, Wireless, ISDN)	YES	Partial	NO
Automatic router discovery/MTU discovery	YES	NO	NO
Advanced network troubleshooting tools (OnNet has IP Trace, Ping & Retriever)	YES	Partial	YES
Automatic scripting capability (Registration Wizard)	YES	NO	NO
SOCKS v4 network firewall support	YES	NO	NO
Netware IP 2.1 (run Netware applications over IP)	YES	NO	YES
NetBIOS over TCP/IP	YES	NO	YES
NFS file locking	YES	NO	YES
A single vendor for host access, resource sharing, transport, Internet client and server with a worldwide sales and support organization.	YES	NO	Partial

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PCMag2Cpn

NETWORK EDITION

COVER STORY

backup events can be saved as jobs and later reused, thanks to a built-in scripting tool.

ARCserve Manager for Windows NT also lets you schedule jobs that run simultaneously across multiple drives, which greatly improves performance. Combined with Windows NT Server's support for multiple processors, this makes it possible to work with as many as 32 drives in a system. The performance benefit was obvious during our Local Backup testing: ARCserve was the fastest performer, with 36MB per minute throughput.

ARCserve's ability to test for viruses on the files you're backing up is another unique and useful feature. If you find a virus, you can choose to back up, skip, or delete the infected file. You can purchase Cheyenne's InocuLAN (single-server version, \$895; Windows NT client version, \$195), which extends ARCserve's basic virus-checking options to include repairing and inoculating infected files.

With solid tape backup capabilities, ex-

cellent NetWare interoperability, and a host of handy additional utilities, ARCserve stands up to your Windows NT server backup needs.

ARCserve 2.01 for Windows NT, Enterprise Edition. List price: \$1,395. Cheyenne Software Inc., Roslyn Heights, NY. 800-243-9462, 516-484-5110; <http://www.cheyenne.com>. Circle 953 on reader service card.

Palindrome Corp.

Backup Director 4.0, Windows NT Edition



If nothing else, a good backup program should make keeping copies of your files a no-brainer. In keeping with this idea, Backup Director 4.0, Windows NT Edition is distinguished by rich tape management and powerful

backup automation features. In fact, the features are so advanced that Backup Director leaves you with little more to do than change the tapes.

Backup Director was obviously designed to anticipate backup problems and stay one step ahead of them. Installation however, is only relatively easy. After you set up the backup server, you have to install agents, called *Connection Managers*, on the clients or other Windows NT servers that you wish to back up.

During testing, we had some problems getting the package's tape driver to work with our HP NetServer 5/66's internal Adaptec AHA-2742 EISA SCSI adapter. When we called technical support, Palindrome representatives told us that they had not yet tested and approved the AHA-2742 for use with Backup Direc-

SUITABILITY TO TASK

Backup Director

Installation and configuration	Excellent
Management and administration	Excellent
Compatibility	Good

Symantec's Alternative Approach

By Tony Pompli

For companies like Cheyenne, maintaining NetWare-based Windows NT backup systems is a valuable migration strategy to offer its customers. Many enterprises are still heavily NetWare-based but are beginning to set up Windows NT servers. For these shops, using familiar backup tools while protecting a new family of servers can be like having your cake and eating it too.

With Norton Enterprise Backup (NEB), Version 1.5, Symantec joins the club. This new package provides full Windows NT client and server backup—all from a familiar NetWare platform. Like its Windows NT-based competitors, NEB can back up critical Windows NT Registry and system files so that not only data but entire Windows NT servers can be restored. Unlike its NetWare-based competitors, NEB features a distributed architecture, which lets you control a larger field of remote servers.

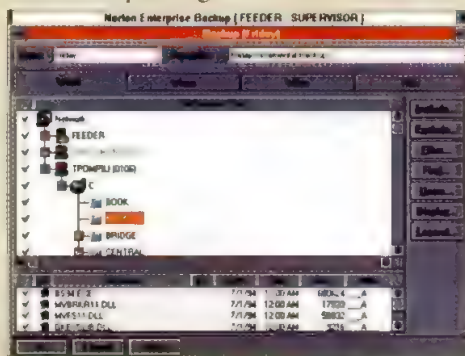
Changes in the product are not obvious. NEB uses NetWare-compatible Target Service Agents (TSAs) to back up Windows NT and Windows 95 PCs, just as it uses TSAs to back up NetWare servers and networked PCs and Macs. You also manage Windows NT server backups from the same NEB Windows 3.1 or Windows 95 management console as before.

Bringing up new servers in the NEB environment is nearly effortless. The NEB system automatically recognizes new

backup servers and makes them immediately available for backup jobs. No need to enter the servers' IPX or IP addresses manually, as you must with Windows NT products such as Cheyenne's ARCserve for Windows and Palindrome's Backup Director.

Other attractive features include a flexible backup topology, which lets you back up a given server or client by picking and choosing from backup servers anywhere on the network. NEB also offers a fault-tolerant backup server strategy. This means that if a server or tape drive fails, NEB automatically forwards the job to another server.

For administrators, NEB offers a multitiered management hierarchy. This gives local backup server managers limited rights to perform restores and other basic monitoring functions. Only the highest-level administrators have rights to config-



SYMANTEC'S NEWEST NEB RELEASE backs up Windows NT servers from NetWare.

ure the backup.

Windows NT backup servers may eventually overpower NetWare-based systems by exploiting Windows NT's multiprocessing capabilities. But for now, many organizations will feel more comfortable dipping their big toes in the Windows NT market and using their NetWare backup tools to protect data on Windows NT servers.

Norton Enterprise Backup, Version 1.5. List price: Multiserver, \$1,395; single-server, \$795. Symantec Corp., Eugene, OR; 800-441-7234, 541-345-3322; <http://www.symantec.com>. Circle 958 on reader service card.

NETWORK EDITION

COVER STORY

tor. When we installed an ISA version of the same adapter, everything worked.

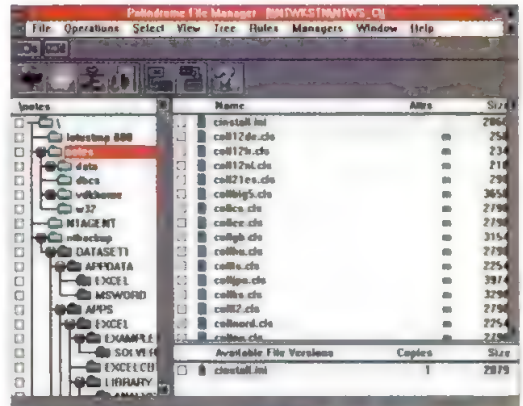
Once you're up and running, configuring a backup—for a Windows NT client or server, or a NetWare server—is simply a matter of entering one of a series of Backup Director Managers and using the Resource Manager to add the target computer to the Protected Resource List. The software takes care of the rest, automatically adding the computer you chose to the list to be backed up and beginning the backup process. Using the Configuration Manager, you can refine settings by creating a specific schedule or choosing a tape drive, but most of the time you'll find that Backup Director's settings work well.

Other Backup Director Managers let you take care of the basics: setting up tape drives, formatting tapes, and moni-

toring the progress or results of a backup session. Trying to figure out which Manager does what can be confusing at times, but it gets easier with use.

Palindrome has gone to great lengths to alleviate hardware headaches. Backup Director works with tape auto-changers and handles all of the popular tape media. In addition, it is the only product reviewed here that works with the new SIFD tape format. Like Cheyenne, Palindrome forgoes Microsoft's built-in Windows NT tape driver in favor of its own.

Backup Director supports a number of tape-rotation schemes, including the popular GFS and Tower of Hanoi. The package lets you select the number of



BACKUP DIRECTOR'S FILE MANAGER lets you back up or restore individual files or groups of files.

tapes you want to enter into the preconfigured rotations. Devising your own rotation system is also a snap: Backup Director fol-

Mirror, Mirror on My Server

By Tony Pompili

If you run mission-critical systems that need their data backed up now—not at 4:00 in the morning—consider Octopus Technologies' real-time backup solution, Octopus 1.5. Like Vinca Corp.'s Standby Server, but

without the hardware, Octopus mirrors volumes and files on the fly, nearly guaranteeing up-to-date mirroring of all your critical data.

With Octopus you select an entire Windows NT volume or machine to mirror. The software automatically copies new versions of files to the backup server anytime those files change. The system doesn't use tape drives; instead it mirrors from hard disk to hard disk. These disks can be on the same machine, or they can be on separate network-connected machines, so you can mirror multiple Windows NT servers and clients to a single Windows NT backup machine. The Auto Switch Over (ASO) option (\$249) will even sense a Windows NT system failure and reboot the server with the backed up files as the original server.

The Octopus software runs on every server—those performing the backup as well as those being backed up. You need a separate software license for each computer (\$999 each). For larger networks, which may have heavy real-time backup needs, this can get pricey, but that raises the old "how much is your data worth" question. The protection you get from mirrored data is almost always worth the sticker shock.

Setting up Octopus requires little more than running the install program on each Windows NT server in the Octopus backup network. You can even place Octopus on remote

servers if you like, which is a nice option for decentralized sites. We installed Octopus on a Windows NT client system and a Windows NT server and selected the files we wanted backed up. When we changed one of the source files by editing a Word document, Octopus automatically sent—or

forwarded, as Octopus says—the change to the server doing the mirroring. You can choose to mirror entire machines, entire drives, individual files, or files selected using a filter. The Octopus technology works smoothly and is impressive to watch.

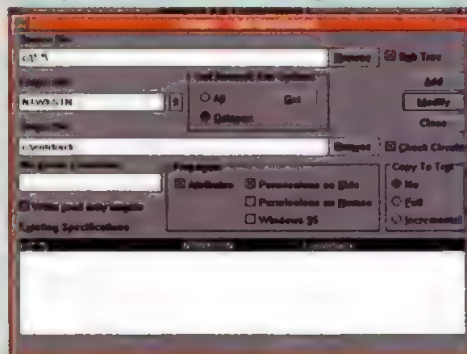
You'll want to keep one detail in mind, though. Octopus backs up only data files, not the Windows NT system files or the Registry. As a result, the source system's Registry—and thus its definitions for everything from the computer's Windows NT name to lists of

users—won't necessarily be in sync with the original server's. Octopus Technologies expects to have a complete hot-swap system to back up both data and system files by this summer.

At press time, Octopus was shipping only a Windows NT version of its product. A Windows 95 version of Octopus, priced at around \$50 per license, should be available by the time you read this. The Windows 95 version will mirror files among other Windows 95 or Windows NT computers.

This is not your typical Windows NT backup solution, but Octopus could prove indispensable to your operations. Sometimes you just can't wait for the sun to go down.

Octopus 1.5. List price: Octopus Server, \$999; Auto Switch Over option, \$249. Octopus Technologies Inc., Yardley, PA; 800-919-1009, 215-321-8750; 74663.2504@compuserve.com. Circle 957 on reader service card.



CUSTOMIZED CONFIGURATION lets you use Octopus to mirror computers, drives, or individual files.

I need access to the R&D server.

We need to be on the Internet in two weeks.

A website. Sure. But what about security?

I need to post this!

...here.

I need to get this file to Belgium. Pronto.

Without on-line news, we're no one.

I'm lost. Help me.

What do you mean I can't access that?

You ain't anyone unless you're on the Net.

Why is this machine so slow?

Just a few modest requests
from your colleagues:

Can we view images?

Is it forward slash or backslash?

Why is computer training so expensive?

Why do I have to learn all these crazy voodoo commands?

Why is the net down?

I left you a voicemail...

Text-only e-mail is so 80s.

Why is MIS always so busy?

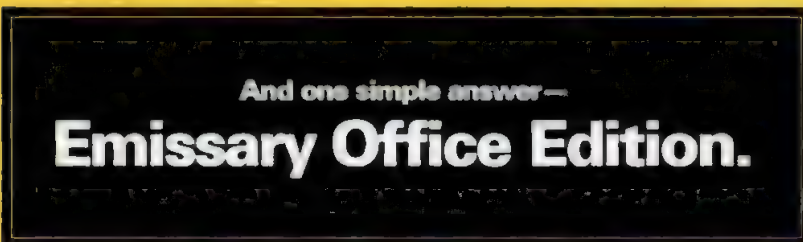




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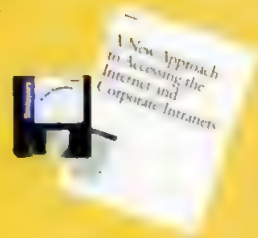
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lows your rotation plan and automatically prompts you for the correctly labeled tape. (No more spreadsheets or yellow sticky notes.)

In addition, the package can read bar-coded tape labels, which is especially useful for working with large tape auto-changers such as Exabyte's EXB-480 or SpectraLogics' Spectra 4000. Don't worry if you slip up and insert the wrong bar-coded tape; the program will always ensure that your computer gets backed up, even if it means performing backups with incorrectly labeled tapes.

Again, like Cheyenne's and Arcada's offerings, Palindrome's Connection Managers let you back up the Registry as well as the Windows NT system files, making sure you have what you need to restore your entire system. Backup Director's one drawback in this area is that, unlike its competitors, it does not perform backups via shares or drive map-

How Does Windows NT Help Your Backups?

Windows NT has several built-in features that can aid the tape backup process.

- The hardware layer houses 63 different tape device drivers.
- The I/O System design speeds backup by letting you write concurrently to tape and disk.
- The I/O System lets apps bypass the cache when you're backing up. This limits the backup's impact on other running services.
- The I/O System also has built-in communications tools that ease the remote backup process.
- At the Windows NT Executive level, the Tape API provides a consistent interface for all tape hardware products.
- The Backup API supports backups of all data, regardless of source or NOS.
- Windows NT Services include a built-in tape backup applet.
- Other relevant Windows NT Services include the Alerter, which can be used to trigger a backup, and the Event Logger, which can monitor a backup. At press time, the packages we reviewed were not yet taking advantage of either of these built-in utilities.

pings. This can be limiting if all you want to back up are simple data files.

Palindrome hasn't forgotten about NetWare servers and their system files, NDS and Binderies. The standard single-server and multiserver Windows NT

packages both include NLMs that serve as NetWare 3.x and 4.x server Connection Managers.

Backup Director tapes are compatible with Palindrome's Backup Director for NetWare, which makes it possible to both run your backup and restore from either platform. The Windows 95 version of the Connection Manager is expected to be available by the time you read this. One potentially limiting factor: You still need NetWare servers running to back up many types of clients, including DOS, Macintosh, Windows, and Unix. Palindrome uses Novell's TSA NLMs on the NetWare server to gateway to client

TSA TSRs. Although this method will pose problems for all Windows NT installations, it generally works well, since most sites have one or two Novell servers running around.

Easy to use, with a powerful set of man-

Media Standards (Finally) Taking Shape

By Steve Rigney

Most emerging product areas carry nagging issues about interoperability. Unfortunately, so do some mature product areas. When you purchase a network backup program, you don't really want to feel as if you're signing a lifetime agreement with the vendor. If you later find a newer or different program you like better, you should be able to switch—and be able to use your existing tapes with the new program.

Until recently, that hasn't been possible. But now two media-format standards point to a future in which you'll be able to use any backup program you want without worrying about losing the data on your older tapes. System Independent Data Format (SIDF) and Microsoft Tape Format (MTF) have each been adopted by a vendor or two in the main story. You'll likely see more vendors come into compliance.

SIDF was developed by Novell as part of its Storage Management Services (SMS) specification. As devised for NetWare, SMS has two pieces: SIDF and the Target Service APIs. SIDF specifies a standard open tape format and a method for packaging the data on the tape. It works independently of the host operating system. The Target Service APIs work with the standard Target Service Agents (TSAs) to provide a consistent interface to all NOSs.

In an effort to bring the standard to Windows NT, Palindrome has built the SIDF media format into its Backup Director for Windows NT product. You can exchange tapes among all of Palindrome's products and any SIDF-compliant

package, including Novell's Sbackup and Stac Electronics' RemServe. Developers at Arcada and Cheyenne also say they are planning to work with SIDF in the near future. SIDF is the only standard that has been certified by the ISO (International Standards Organization).

MICROSOFT'S TWO CENTS

The second major standard is MTF, which is currently available only in Backup Exec and the backup applet that comes with Windows NT. MTF is owned by Microsoft, has been developed specifically for Microsoft OSs, and is probably not going to be heartily endorsed by NetWare backup vendors.

Right now, for example, even though Arcada works with MTF in its Windows NT and Windows 95 products, the standard does not carry over to its NetWare-based packages. So you can't exchange tapes between Backup Exec for NetWare and Backup Exec for NT.

Although Cheyenne currently does not adhere to either of these standards, it does offer compatibility across different versions of ARCserve. As long as you keep using ARCserve—or any other Cheyenne backup product—you shouldn't experience any problems exchanging tapes.

Adherence to multiple standards within a single product is probably not far off. Palindrome works with SIDF, and Arcada both follows MTF and offers the ability to read the proprietary Cheyenne media format. If vendors decide to work together, you might see a product that can read and exchange tapes among all of the popular media standards. Imagine!

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more Windows NT targets across any LAN and WAN. Octopus ASO can even be used to configure a target system to automatically assume the role of a failed source system — with no human intervention. Purchasing Octopus is easy and it comes with an unconditional 30-day guarantee. Return it if you don't think it's the most valuable Windows NT utility. Then again, you could do nothing, and run the risk of getting really hoed.



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agement utilities, Backup Director will ease the backup burden for any enterprise network backup administrator.

Backup Director 4.0, Windows NT Edition. List price: Single server, \$995; multiserver, \$1,595. Palindrome Corp., Naperville, IL; 800-288-4912, 708-505-3300; <http://www.palindrome.com>. Circle 954 on reader service card.

Arcada Software Inc.

Backup Exec for Windows NT, Enterprise Edition 6.0

Arcada Software began its relationship with Microsoft by writing a backup applet supplied free with Windows NT, so it's not surprising that the company's Backup Exec was the first standalone Windows NT backup package. A tried and tested product with a simple interface and installation routine, Version 6.0 of the package is well suited for small- and medium-size

Windows NT backup sites.

Arcada understands the underpinnings of Windows NT pretty well, and it shows in Backup Exec's architecture.

Backup Exec is the only product here that uses the Windows NT tape driver and supports the Microsoft Tape Format (MTF). And there's more: Microsoft has included a Backup Exec client agent in Windows 95.

Offering good, basic Windows NT backup services, Arcada's entry in this market backs up clients through the Windows NT-provided administrative shares. Like the other products here, it also backs up necessary system files and the Registry. And like its competitors, it can back up Windows NT HPFS, NTFS, and FAT file systems. Backup Exec also works with a wide array of media types. And with the optional Autoloader Module (\$495), it works with tape auto-loaders.

Backup Exec doesn't use client agents, which streamlines its installation. All you do is install the software on the backup server and you're ready to roll. Like its competitors, Backup Exec installs as Windows NT services. This lets it automatically start and stop operation when you bring the Windows NT server

up and down.

Like the other products we reviewed, Backup Exec lets you schedule and automate nightly tasks. *Jobs*, or definitions of the files or computers you want to back up, can be saved in reusable Job Selection Lists. You can add, delete, and modify jobs in these lists as backup tasks change.

Strong ties to Microsoft and solid basic capabilities don't, however, make up for problems with the package. The client agent included in Windows 95 doesn't work, and Version 6.0 of Backup Exec doesn't include a separate Windows 95 agent. What's more, in the product we tested, Arcada did not provide a way to back up NetWare servers or most popular client types. Arcada says it will ship a NetWare backup agent by the time you read this.

During our testing, the package was not able to back up everything we threw at it. While testing with Windows NT application files, we found that Arcada was the only program that couldn't back up open Notes, Release 4, databases. This is problematic; by its nature, Windows NT is more likely to be running applications than other server platforms such as NetWare.

The interface is relatively simple, but it's divided into two parts: Backup-Exec and ExecView. Backup Exec does most of the work creating backup jobs, assigning jobs to tape drives and scheduling, while ExecView monitors the job queue. It would make more sense to organize these elements into one program.

Also, though Backup Exec technically supports parallel backups (in which you back up multiple clients to multiple tape drives simultaneously), it does so only if you run multiple versions of the program. This process is inelegant and sucks up Win-

dows NT resources. ARCserve and Backup Exec simply spawn another thread to perform parallel backups.

Some improvements are on the way, and Arcada remains heavily involved with Microsoft. In addition to working on the next version of the Windows NT backup applet, the company has released an updated version of the Windows 95/Windows/DOS client agent. The updated agent is available on Arcada's BBS (407-444-9979). Arcada does not currently include any NetWare client, Mac, or Unix client agents as part of

the Backup Exec package. These ship separately, starting at \$495 per backup server.

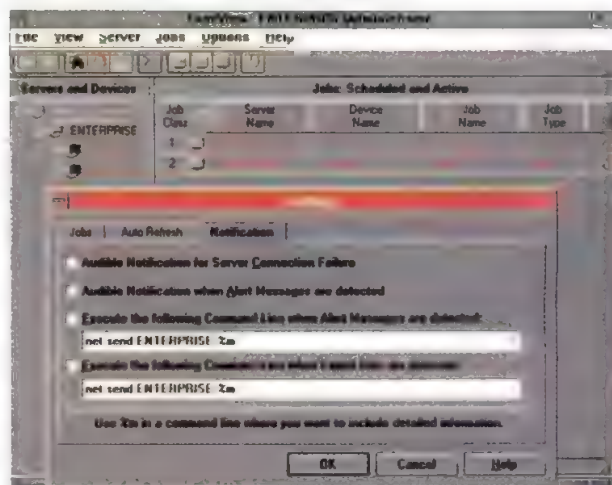
Backup Exec is a simple, basic choice for Windows NT-only sites. The forthcoming client agents that work with NetWare servers will make the package more useful for the typically diverse networks in today's organizations. Remember, though, that there's no tape-level compatibility between the Windows NT and the NetWare versions of Backup Exec. And its clunky parallel backup support could cause intolerable bottlenecks. □

*Strong ties to Microsoft
and solid basic
capabilities don't make up
for some shortcomings
with this version of
Backup Exec.*

SUITABILITY TO TASK

Backup Exec for Windows NT

Installation and configuration	Excellent
Management and administration	Good
Compatibility	Poor



YOU CAN SET NOTIFICATIONS to alert you to problems with your Backup Exec network backup.

Backup Exec for Windows NT, Enterprise Edition 6.0. List price: Single server, \$695; multiserver, \$1,295. Arcada Software Inc., Lake Mary, FL; 800-327-2232; <http://www.arcada.com>. Circle 955 on reader service card.



Lotus.

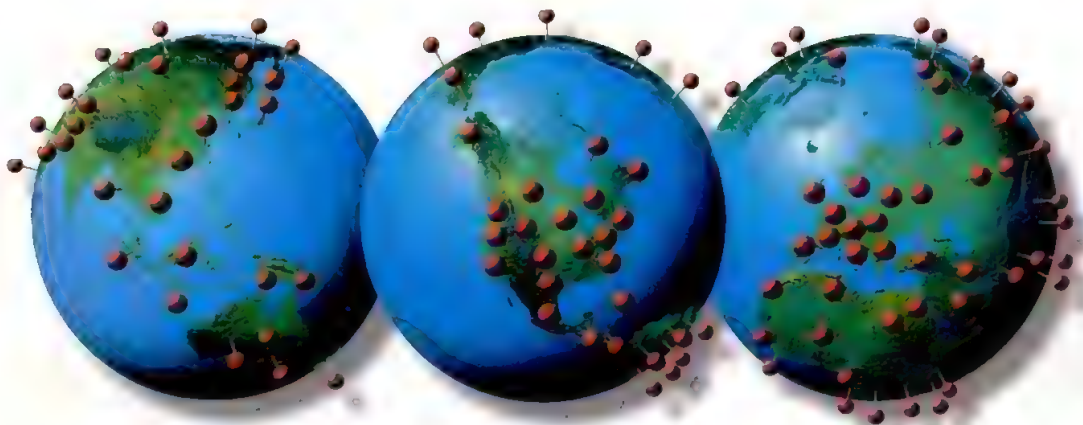
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The Source for Business Productivity

Welcome to *The Source for Lotus Business Solutions*. This directory showcases some of the top providers of business solutions developed using Lotus technologies. It also contains valuable articles that explain the enhanced application development environment of Lotus Notes Release 4, and show how Notes can be used to link mission critical workflow applications to the Internet.

With over 11.5 million users, Lotus is by far the leading provider of software for building integrated messaging and groupware solutions. Solutions built with Lotus Notes, cc:Mail and SmartSuite help people get their jobs done faster and better and enable teams of people to work together more productively than ever before. Using their power to dissolve organizational and geographical boundaries, Lotus Notes, SmartSuite and cc:Mail products make it possible to run an efficient, distributed organization with satellite offices and mobile personnel all working with the same critical information.

Lotus' growing community of over 12,000 Business Partners are helping customers achieve tremendous productivity gains by using Lotus' award-winning products as the foundation for building a wide variety of applications and solutions for industries as diverse as health care, legal, pharmaceutical, insurance, manufacturing, retail, petrochemical, publishing and financial services. And now with Lotus Notes Release 4, Lotus Business Partners are helping customers get the most out of their Web browsers by allowing them to fully participate in Notes business process applications.

As you peruse this directory, please note that it contains a cross section of Business Partners, including application developers, consultants, service providers, education centers, system and network integrators, support centers and resellers. Right now they are designing, customizing, implementing and supporting Lotus groupware-based business solutions for companies just like yours — solutions that can deliver an unprecedented return on your technology investment and make your organization more productive than ever before.

Don Bulens
Vice President, Business Partner Programs
Lotus Development Corporation



Table of Contents

A Word On Lotus Notes	4
What's New in Notes R4?	6
Lotus Notes and the World Wide Web ..	18
Case Studies	
▶ State of Missouri & WORDLINK....	11
▶ PerSeptive Biosystems Inc. & Cambridge Software Group Inc. ...	14
▶ Merck & Co. & SandPoint Company ..	15
▶ Colleague Health Care & NetImage ..	22

A Word on Lotus Notes

Lotus Notes is the industry-leading integrated messaging and groupware product. Ironically, there is little agreement among industry analysts, customers, business partners and competitors regarding what Notes really is. It has alternately been described as a client/server platform for developing and deploying groupware applications, a platform for highly-specialized applications, and an open environment on which independent software developers can integrate their own products.

Notes is a product that has many faces. Most people think of Notes as the applications they see and run in the Notes environment — mail, discussion databases, etc. The power of Notes is that these applications are merely specific instances of a broad range of applications that can be written in Notes.

For example, there is no real "Notes conferencing system," rather, there are many instances of conferencing systems that can be written in Notes — because Notes is, at its core, an applications development environment. Oftentimes, someone will take an existing conferencing application and customize it, adding fields to the forms so that structure can be added for a specific purpose (e.g. when information is added about a customer inquiry, fields that state the details of the inquiry are filled in, the level of urgency is noted, etc.). Once this is done, a new conferencing application exists that is tailored to a specific type of collaboration.

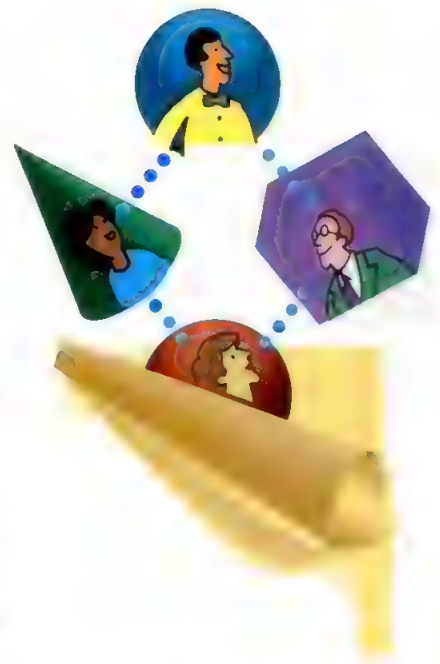
These applications all take advantage of Notes' underlying platform-level services, such as messaging, object store, replication, security, and applications development. The Notes technology serves as a flexible groupware platform or framework upon which groupware applications can be built and deployed.

From its inception, Lotus Notes has combined three powerful group support technologies—messaging, dis-

tributed object store, and a rich applications development environment — to form a component architecture that serves as the basis for a large variety of groupware applications. It has been unique among groupware systems in putting forward a database model for groupware — both in terms of the underlying user metaphor and the design tools available to end-users and IT organizations. It supports end-user tailoring tools to make simple changes to data structures and database views. It also supports a rich set of APIs for developers who wish to build alternative UIs that also leverage the database model.

The implementation of the distributed database technology is also a unique advance — still far ahead of any other groupware product. Lotus Notes' robust replication over occasionally connected networks made deployment possible at a time when few organizations had achieved full network connectivity across their enterprise. It also anticipated the growing need for true disconnected use on workstations and notebook computers.

An entire industry of independent software vendors, systems integrators, application developers and consultants has evolved around Notes. Lotus continues to cultivate this community to help ensure that



customers have the resources available to install, develop, deploy and manage Notes-based applications. Lotus

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What's **New** in Notes R4?



users new tools and facilities with which to accomplish the same types of tasks or altogether new ones.

The guiding principles in developing the fourth release of Notes were:

- Make Notes more intuitive and easier to use for a more diverse spectrum of end-users, especially mobile users.
- Increase programmability and design options for developers and end-users.
- Upgrade Notes to support enterprise-wide and inter-enterprise mission-critical applications through increased manageability, availability and scalability.

Of course, the essence of Notes remains its distributed document store, its system level services such as replication and security, its integral messaging system and application development environment. The modifications discussed here simply make these core components of Notes more robust, accessible and easy to use.

Improved User Interface

For end-users, work in Notes consists of finding, viewing and creating (or modifying) information. Notes R4 improves the user experience for each of these activities.

Finding information. The first thing users of R4 will notice is the introduction of a multiple user interface that allows them to "surf" documents. The panes include a folder window, a document list window, and a document viewing window. This reduces the amount of effort required to browse through a database for a document.

Some R4 applications will depart entirely from the standard Notes view, employing Navigators — a fully graphical interface that makes use of hot spots to guide users to particular documents or functions. For example, a Notes application might appear as a regional map, with specific state and local areas that the user can "click" on to launch a view or a document, or initiate a Notes action, such as replication or update.

Users will also be able to conduct easier and more complete searches for information. The standard Notes full text search facility has been enhanced with a point-and-click query builder. Furthermore, users will be able to search on attachments and OLE objects in addition to fielded text.

Viewing information. The end user's ability to customize a view that meets his or her specific needs has been one of the hallmarks of Notes. Notes R4 makes this function easier to perform, so that any user can create and customize views.

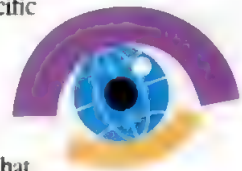
Reading a document will be easier in Notes R4. Users will be able to view file attachments without having to detach or launch them, even if the application used to create the document does not reside on the user's desktop. Notes R4 ships with over 150 file viewers for the most common spreadsheet, word processing, presentation graphics and other file types. Users will also be able to preview Notes documents before opening them, and documents themselves will include collapsible sections so that users can more easily manage browsing through and reading lengthy documents.

Creating and modifying information. Notes R4 includes an improved document editor to simplify many common end-user tasks. Quick bullets, named styles and enhanced table formatting, as well as context-sensitive menus and SmartIcons, make common editing tasks easier to perform. The introduction of a Permanent Pen eliminates the burden of highlighting and formatting each new comment or addition to an existing document.

R4 is a full OLE/2 container and client: it supports OLE/2 in-place editing, drag-and-drop and OLE automation.

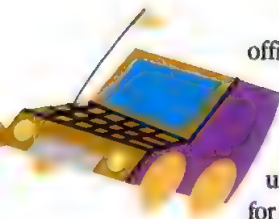
Enhanced Mobile Support

The other focus of improvement to the end-user experience with Notes is in remote and mobile computing. True mobility allows the user to regard an



If you are a current user of Notes, Release 4 will impress you with its improved ease-of-use, navigation and more accessible functionality. Application developers familiar with the Notes development environment will appreciate the addition of robust new tools and facilities, and system administrators will find the management and scalability of Notes R4 greatly improved.

In designing the specifications for Notes R4, Lotus has targeted six functional areas — an improved user interface, enhanced mobile support, world class messaging, robust application development facilities, industrial strength scalability and manageability, and complete integration with the Internet. In some cases, existing functionality has been enhanced, made easier to use or made more readily accessible to the user. In other instances, entirely new functionality has been added, giving all



office as a set of tools and capabilities instead of a physical place. Notes is already unique in its support for mobile users, but R4

includes some additional enhancements. Mobile users can more easily perform selective replication using a point-and-click dialog box. On the road or at a remote site, users can employ Notes' location profiles, which "remember" special dialing instructions and mail and document handling preferences for replication.

When users need to replicate more than one database on more than one server, they now only have to make one connection to a server. The replication process will pass through the single connection to connect with other servers.

World Class Messaging

One of the most popular uses of Notes is as a mail system, and Notes R4 includes many significant enhancements to the Notes mail user interface and functionality. Most important is the adoption of the award-winning cc:Mail user interface specification, including cc:Mail's three-pane win-

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Enhanced Partner Program Planned

Lotus and IBM are rolling out some enhancements to the Lotus Business Partner Program during 1996. Plans include developing three levels of membership — Member, Qualified, and Premium — to recognize Partner experience, and segment Partners by business model. These models will closely resemble the core competencies of Partners — such as consulting, application development, and system and network integration — as well as those skill sets sought by customers looking to engage a Partner in a Notes or cc:Mail deployment. The levels are intended to reward partners for increased commitment and experience with the technology. The Program gives partners at each level an increasingly rich set of skills development and information tools.

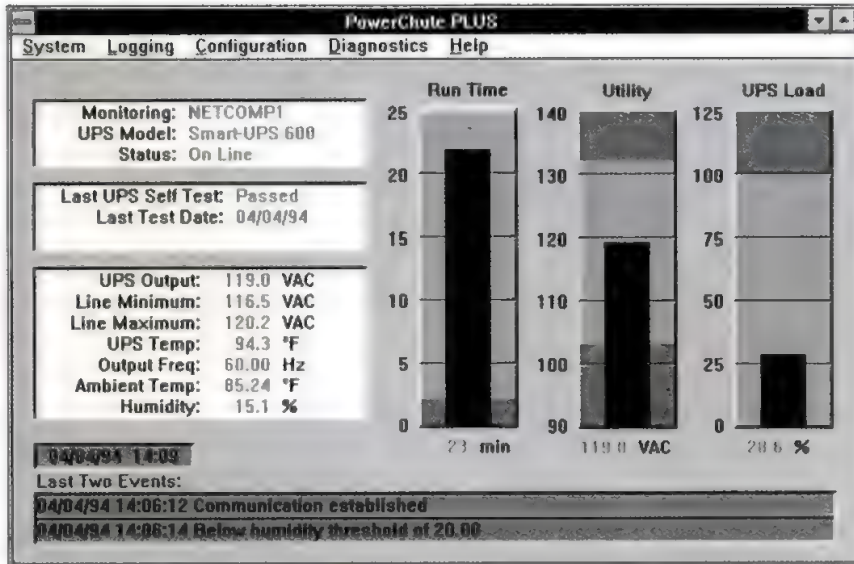
New Partners will be in the Member category. They will receive resources such as CDs that offer Lotus software and other business applications to help run their company. Lotus believes this will give Members the opportunity to learn the technology and

its uses firsthand. They will also be invited to "attend" monthly Lotus Vision TV broadcasts and local field-based seminars that focus on various time-sensitive technical issues related to developing and integrating solutions with Notes, NoteSuite, and cc:Mail.

Qualified Business Partners will be required to have either a certified employee on-board or a certified commercial product that meets Lotus standards. The business must also be connected to Lotus on-line. They will have access to pre-release software as well as a wider range of marketing programs than Members.

Premium Partners — top tier partners — will be required, as they are today, to demonstrate a high level of commitment to Lotus and the technology. They will receive a wider range of sales, marketing, and support programs than the other Partner levels. These include the opportunity to participate in cooperative marketing programs, sales leads, and the benefit of an assigned account representative.

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VP Notes Product Division,
Lotus Development Corporation



LOTUS NOTES



APC's PowerChute *plus* works in conjunction with APC's UPS systems to provide graceful, unattended shutdown of Lotus Notes servers in the case of an extended utility power interruption.

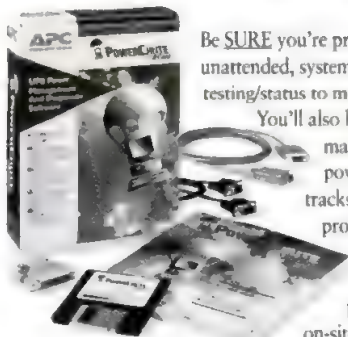
Serious Consequences

Ungraceful shutdown can have some serious consequences on your server. For instance, an improperly closed Lotus Notes Server can result in:

- 1) Lost database requests creating confusion, redundant work, and lost productivity
- 2) Lost/Corrupt data or databases significantly reducing productivity
- 3) Uptime delays while Notes performs "Consistency Check" to restore server to a working state.

Solution

APC's PowerChute *plus* offers a powerful, easy to manage solution for Lotus Notes Servers. To shutdown Notes via PowerChute *plus*, the user calls the APC shutdown utility for Notes. Once Notes is shutdown, PowerChute *plus* proceeds with normal system shutdown. When the NOS has been completely shutdown, PowerChute *plus* puts the UPS to sleep to be restarted when the power returns.



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PowerChute *plus* provides network administrators with more useful information which allows greater flexibility in configuring the UPS's reaction to power events, significantly enhancing UPS performance.

Lotus Notes and PowerChute *plus*

APC's PowerChute *plus* power management and diagnostic software is compatible with more than 40 operating systems. PowerChute *plus* works with APC UPSs to shutdown your system automatically and gracefully in the event of an extended power outage, whether you're there or not. For Notes users an added script file shuts down Notes servers just before shutting down the operating system.

Remote Reboot Capabilities

Notes servers running NotesView can be managed remotely using APC's PowerNet SNMP Adapter accessories. These allow for hard reboot of a remote Notes server that has locked-up.

In addition, APC's Call-UPSII accessory can bypass network lockups by direct dialing the Notes server to gain the access necessary for remote reboot.

Modem-line protection

With many remote users connecting to Notes servers via modem, APC recommends the new PNET4 and PTEL1-4 data line surge suppressors to protect your server from incoming surge induced damage. The internal modem of a laptop is highly susceptible to surges travelling along serial and modem lines directly to the CPU, and must be protected by an APC ProtectNet device. Call now for info.

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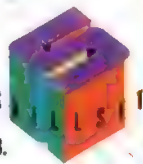
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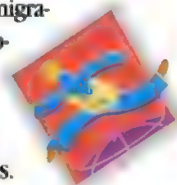
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dow for easy scrolling and viewing of mail messages. This not only makes the Notes mail experience more intuitive, but makes Notes R4 visually consistent for cc:Mail users who have switched. Also aiding in migration is the inclusion of a MAPI service provider interface (SPI) in the Notes server, which allows MAPI clients — including the forthcoming cc:Mail release 7.0 — to access the Notes object store for messages.



The Notes mail database will also feature a number of ease-of-use enhancements. Users will be able to take advantage of a number of delivery options including "mood stamps" — graphical icons and symbols to indicate the urgency or confidentiality of a message; "prevent copying," which does not allow the recipient to forward or copy the content of a message; and "trace path," which provides the server route that a message traveled through to reach its destination.

Another enhancement is the ability to add proxy addresses to a directory, so that in addition to Notes addresses a user can have an Internet, X.400, cc:Mail or other mail address.

The Notes mail database will also include a set of predefined agents that a user can invoke, including an "out of the office" message that informs senders of a user's availability, an "add sender to address book" function that automatically copies the contents of the "FROM:" field to a personal name and address book, and an "archive selected documents" function that will automatically create an archive at convenient hours.

Robust Application Development

In Notes R3, Lotus concentrated on functionality to help developers build workflow applications to aid organizations in automating critical business processes. Companies using Notes soon found that they could improve their core processes — customer service, sales prospecting, new product development — in ways never before thought possible.

In Notes R4, Lotus has significantly enhanced the programmability of Notes by extending the Notes API to more platforms and languages, adding new functionality to the native Notes development environment, and further easing the deployment of Notes applications.



Programming at the API level. Professional application developers often approach Notes from the Notes API, from which they enjoy direct programmatic access to Notes' rich functionality and system-level services. R4 improves and extends the Notes API in several key ways. First, the Notes API has been extended to the Macintosh platform, giving Macintosh developers all the features and functionality enjoyed by OS/2, Windows and UNIX developers. Furthermore, Lotus has raised the level of

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after all,
heaped
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awards
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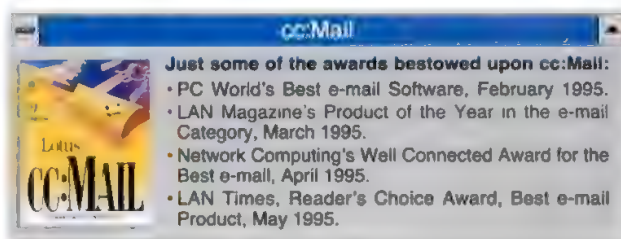


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abstraction for developers using high-level languages and the Notes API. There are specific implementations of the Notes R4 API that will support Visual Basic, LotusScript and C++. These higher level APIs reduce the complexity of working directly at the API level, and exploit developers' existing expertise in popular programming languages.

Programming in the native Notes development environment. Notes R4 improves the native Notes development environment in two ways. First, it provides developers with altogether new, modern and industrial strength tools. Second, it enhances the ease-of-use from a developer's perspective, reducing the number of steps required to complete a programming task and making the development environment more intuitive.

New tools and functionality. The most significant new tool is LotusScript, a BASIC-compatible structured programming environment. LotusScript is a fully object-oriented programming environment with classes, methods and properties, providing developers with a consistent way to access Notes services.

Integration with non-Notes data is easier in R4 through the use of LotusScript Data Object (LS:DO), a LotusScript class and set of methods, properties, and events that allow access to relational and legacy databases using ODBC. LS:DO provides both read- and write-access to back-end databases, so that Notes workflow and replication capabilities are available to developers who want to create advanced applications that combine relational databases and Notes.

Notes R4 also includes an agent builder. Agents are Notes application logic (written in LotusScript or the

macro language, or created from simple actions) that allow developers to automate application tasks on both servers and clients. Such tasks include data handling, replication, and messaging services. Since agents may run on both Notes servers and clients, developers have complete control over the Notes messaging and database infrastructure.

Improved Development Environment

In addition to providing developers with new tools and functionality, Lotus has concentrated on making it easier to create Notes applications by enhancing the development environment

pg. 14

STATE OF MISSOURI & WORDLINK



In March 1995, the Missouri State Highway Patrol chose to implement Lotus Notes to manage its paper-based investigation process. The Patrol's

Information System Division managed a project that resulted in the development of their Violent Crimes Tracking and Management System. Using internal staff and consulting services provided by WORDLINK, a Premium Lotus Business Partner headquartered in Champaign, Illinois, the application was successfully implemented in July 1995.

Now, with Lotus Notes, as a call comes in that a violent crime has occurred, analysts are dispatched to the scene carrying a laptop computer running Notes. The analyst completes the proper reports, inputting information on every detail and keying in information each witness has provided. The analyst begins by entering the basic information on the main report form, case number and date. Then each subsequent report is linked to the first. There is a standardized form for autopsies, witness statements, etc.,

and Notes manages the information on those reports so that it can be viewed in a consistent format.

"The new system has improved our ability to manage the high volume of data associated with violent crime investigations," said Jerry Wethington, IS Director of the Highway Patrol. It allows the investigators to logically organize the evidence and information collected. "Utilizing Notes' full-text searching capabilities has enabled investigators to identify common characteristics among cases that would in the past have seemed unrelated," commented Wethington. The ability to connect case information increases the number of leads to investigate, flagging information that the officers may not have seen under the old system.

"Notes also provides us with the ability to put together a formal, comprehensive case book for the prosecution," said Wethington. With fully-indexed, standardized reports, cases are well organized and much easier to investigate and prosecute, which should result in more convictions.

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Well, now Lotus Notes works hand-in-hand with IBM's scalable ImagePlus®. This is the same imaging solution that handles millions of documents every day in some of the world's busiest financial and insurance companies.

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itself, making common tasks easier to complete and presenting the developer with a more intuitive and useful interface.

Two features that current Notes developers will readily recognize are the use of subforms and a non-scrolling action bar within forms and views. A subform can be inserted within any number of other forms. This improves the degree of reuse of Notes form design. Subforms are stored the same way as forms in a Notes database.



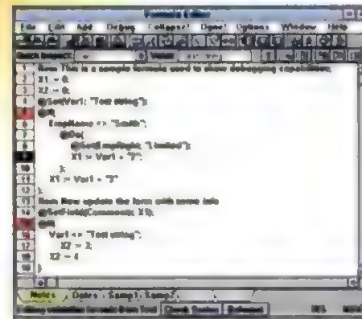
The R4 action bar is a non-scrolling area that remains "affixed" to the screen when the user scrolls through a Notes form or view. This allows developers to create actions on the action bar while looking at the appropriate fields on the screen, rather than switching back and forth.

For end-users with only moderate Notes development experience, Notes R4 includes considerable programming functionality without requiring any knowledge of LotusScript or macro language syntax. More fully functional application templates combined with easily modified canned actions makes end-user application development more realistic for a larger number of users.

Notes R4 includes a number of other features that make it easier to get end users up and running with a Notes application. Once in a Notes applications, users can take advantage of Navigators and hot spots. For example, developers can create a Navigator that displays a map of a sales territory. The user clicks with a mouse on a hot spot, such as a city within the map, and the developer can display a Notes Document and/or View. With Navigators, developers can create Notes

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PERSEPTIVE BIOSYSTEMS, INC.

S CAMBRIDGE SOFTWARE GROUP, INC.



PerSeptive Biosystems designs, manufactures and markets proprietary products and systems that increase the ability to purify, analyze and synthesize biomolecules for applications from research to manufacturing. Based in Framingham, Massachusetts, PerSeptive Biosystems began looking at Lotus Notes in December of 1994 to provide a vehicle for the sales forces' distributed information.

Prior to implementing Notes, all of the company's sales and marketing information existed in several disparate systems. These different applications made it very difficult to manipulate and view information in different ways. In addition, their sales force was spread across the world and they were in need of a system that would effectively distribute leads to the field.

For the installation and application development of Notes, PerSeptive Biosystems partnered with Cambridge Software Group — a Premium Lotus Business Partner that specializes in Lotus Notes consulting services for

Notes Applications Development and Notes Integration with other applications. Cambridge Software assisted with the development of an advanced quoting system for PerSeptive Biosystems' sales application.

As the company began to implement its Notes-based sales force automation system, it realized that other Notes-based databases were essential to build a foundation for the sales administration database. Therefore, PerSeptive began to develop applications that focused on other aspects of the company — such as marketing and communications, help desk information, human resources and administration — and found that Notes was able to help where qualitative information was needed regarding clients, projects and equipment.

With Lotus Notes, PerSeptive Biosystems is able to leverage fewer resources worldwide as the number of Notes-based applications continues to grow. And, through shared databases, all employees, regardless of location, are able to communicate and share information that is vital to the success of the company.

applications that do not require that users learn the Notes user interface. Instead, the end-user's business terms and visualizations are used in

Navigators to assist end-users through the application.

Users will also find it easier to launch executables from directly within the Notes Workspace and from within OLE servers.

Industrial Strength Scalability and Manageability

Notes R4 has been designed to fully support enterprise-wide and inter-enterprise mission-critical applications through increased manageability, availability and scalability. This has been achieved by introducing a new management tool and improving the reliability and scalability of Notes servers.

MERCK & CO.

SANDPOINT COMPANY



As a worldwide, research-based pharmaceutical manufacturer, Merck & Co., Inc., based in Whitehouse Station, NJ, relies on several sources of external information for monitoring any possible competitors to its pharmaceutical compounds during development and marketing, tracking the scientific and commercial potential of its existing products, and for up-to-date information on recent clinical trials and new chemical entities. Until two years ago, Merck relied heavily on internal staff to manage and disseminate this information.

In 1993, Tom Oberleiton, Associate Director of Business Information for Merck & Co., reevaluated the process and transitioned over to an integrated system based on Lotus Notes and a product called SandPoint Hoover™ from Lotus Premium Business Partner, SandPoint Company in Cambridge, Massachusetts. His aim was to switch from a service bureau internal structure and leverage on technology to empower Merck's decision makers with direct access to information at the desktop level. He chose Lotus Notes as the best management and dissemination platform and Hoover as the best software for gathering information. Providing a single user interface, Hoover is an active "information agent" that searches, retrieves and integrates information from over 5,200 sources, including live news feeds, on-line databases, and internal intelligence.

Oberleiton and SandPoint worked together to tailor Hoover to Merck's specific needs. Incorporating targeted solutions such as SandPoint's Competitor Compound Tracking System and a number of Pharmaceutical Databases, the result was a complete network that allows Merck & Co. to receive customized news feeds on a daily basis and search at will through important pharmaceutical studies, on-line databases and publications.



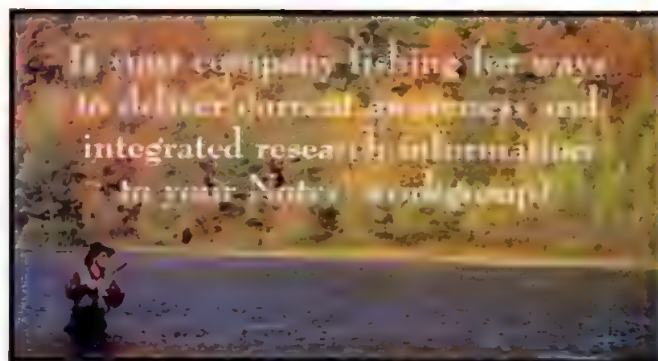
Notes View is an SNMP-compliant network management tool that provides administrators with centralized monitoring and control of servers. With Notes View, administrators can view the status of servers on a real-time basis and manage servers remotely. They can make changes to field-based servers from a central management site, or vice versa. Changes can even be made from a Notes View laptop that is disconnected from the network. As a modern management tool, Notes View features a graphical user interface, and provides administrators with topology maps as well as standard Lotus facilities such as InfoBoxes and charts. Because it is SNMP-compliant, it easily sits within a company's SNMP-based management platform,

allowing it to fully exploit the larger multiples of multi-processor machines. This will improve the availability and scalability of servers, helping to ensure user access and reducing the number of servers required to support a large Notes implementation. The improved scalability should support over 500 active users in a concurrent session and up to 1,000 light users.

Furthermore, replication has been streamlined and simplified. First, speed has been increased by order of magnitude, reducing the amount of time consumed by replication. Second, R4 supports field-level replication, reducing the amount of data that must be synchronized during the replication process. And third, hub servers will support multiple replicators, so that replication can be performed in parallel instead of as a sequential process.

such as IBM NetView/6000 and HP OpenView.

R4 is based on a full 32-bit architecture,



Wade into the gushing flow of electronic data—realtime news, online services, and corporate intelligence—and you can spend hours casting about for information.



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For more information about how Hoover from SandPoint can automatically land the information you want, call us at 1-800-775-4442.



SandPoint



SandPoint Hoover, for Integrated News and Research

Complete Integration with the Internet

Notes R4 builds upon the current Internet support of R3 to more fully integrate Notes with the Internet.

The replication process will be easier to set up and manage, with IP addresses appearing as any other Notes server in a replication dialog box. Administrators will be able to set replication time-outs to account for the sometimes unpredictable nature of Internet connectivity. A server can be directed to wait for a specific period of time to allow another server to get connected.

Support of "anonymous" clients — access to a server on the Internet without exchanging public and private keys — will allow an organization to make a Notes server accessible to any Notes user on the Internet.

The InterNotes Web Navigator can translate a URL into a Notes document. The document retains the fidelity of its original look and content, but is now managed in a Notes environment. **11/93**

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(NOTES FROM THE FIELD) BURGER KING

In 1994, we needed to rapidly deploy field-based teams in a major Burger King re-engineering. Lotus Notes emerged as the only product capable of meeting our timetable. Its advanced replication, superior mobile and collaboration features proved essential. In just 7 months we had 1200 users worldwide. And by year end, we had developed and rolled out five major applications.

Neil Foley

Director, Distributed Systems,
Burger King Corporation

application, or even on the Web. And Notes' unique replication technology lets you be part of the team, even when you're traveling. That's because Notes is the only proven, open platform for communicating, collaborating and coordinating mission-critical business processes.

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Lotus Notes and the World Wide Web

Both Notes and the Web were invented to support collaboration over local and wide area networks. Like other technologies, such as relational databases and desktop productivity tools, that share some attributes with groupware in general, the Web is sometimes viewed as redundant to, and thus competitive with, Notes. However, just as those other technologies are appropriate to their own class of applications and have proven of greater value when integrated with Notes rather than used instead of it, a look at the Web and its applications reveals its distinct and complementary nature to Notes as well.

World Wide Web Applications

The Web provides a global, public means of information publishing and consumption that is based on a "pull" model. Web clients specify the URL or document name and request a copy of that HTML page, which is transmitted across the net, then displayed on the client's workstation. Those pages offer a document-centric, rich-media presentation of information, as well as a hyper-text linking structure.

The World Wide Web is an ideal way to make marketing, corporate, and service and support information readily available for public access. In this way, the Web naturally complements traditional forms of communication, such as direct mail, advertisements in various media, "fax back" systems, toll-free telephone lines, and interactive voice response systems. Planned security and application development enhancements to the Web aim to make it a viable medium for transaction-based electronic commerce.

Lotus Notes Applications

Like the Web, Lotus Notes has been used by many organizations to serve as a publishing medium, focused more on information sharing within and among organizations. It has been Notes' role as platform for application development



and deployment that has established it as a groupware standard. Notes' object model, messaging services, security facilities, desktop and database integration and client/server architecture lend themselves to a class of applications not feasible on the Web. The characteristics of such applications include one or all of the following:

- ♦ **Interactivity.** Business collaboration requires the active participation of team members, not just the one-way sharing of knowledge from one source to many readers. Brainstorming, idea sharing and problem solving require that all participants contribute their input.

- ♦ **Notification.** Finding the right piece of information at the right time by browsing through a library of documents is an inefficient process. In many cases, users would benefit from having the information find *them* at just the right time. A system that combines information storage with integrated messaging services, such as Notes, augments the "pull" model of the Web with a "push" model of information distribution. When an author posts a new item to the system, an E-mail message can also be created that contains a pointer to that information and sent to the appropriate coworkers. Recipients simply click on the pointer to view the relevant document. To do this on the Web is a complicated multi-step process.

- ♦ **Triggered processes.** Similarly, Notes itself can monitor the state of

data, initiating an action based on the state of particular fields. In many cases, the action may be the direct result of a lack of user activity (a sales person has not contacted a customer in 30 days, a contract to be approved is waiting for a specific person for over 24 hours) or an external condition (a client's credit rating has changed, a deadline is approaching). Such an application requires the ability to develop server-based agents.

- ♦ **Customization.** In many collaborative applications, individuals will find reason to want private, tailored views of data that support their specialized tasks. The capability to flexibly view information in different ways is fundamental to enabling all participants to grasp the key elements of the business process and the context in which they exist. Notes forms and views provide each user with the ability to customize how information is presented to them without affecting the logic of an application.

- ♦ **Multiple levels of security.** Some business documents contain information appropriate for some readers but which should remain hidden from others. For example, a personnel review form might be routed through a series of team members for comments. It would not be appropriate for all members to be able to read the comments made by others or view the salary information, so those fields should be hidden from general view, while authorized readers have access to the entire form. While the Web is developing some measure of security and authentication, it will be some time before it can be applied to specific fields within a document.

- ♦ **Integration with other resources.** Not all information is native to a collaborative system: some shared information resides in desktop productivity tools (e.g. spreadsheet tables) and host-based relational databases. Collaborative systems do not replace these systems, but rather must seamlessly integrate with them, so that as changes are made in a desktop document or a database, they are automatical-

ly reflected in the collaborative system.

♦ **Mobile user support.** More and more users today need to perform their work away from the office. Users need to be able to continue to browse through data, compose edits and responses, and complete steps in a workflow process even while disconnected from the corporate or public network. Replication services allow users to make a copy of a database on a laptop computer, work with it while traveling, and later synchronize all changes with the server.

Notes and the Web: Distinct & Complementary

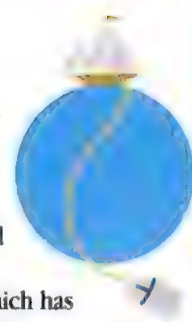
By its very nature, groupware overlaps with other information technologies. The commonalities between groupware and these other technologies do not render them competitive; on the contrary,

groupware is essentially complementary to them. Each technology supports a distinct class of applications, while their integration with groupware leverages the strengths of both.

Likewise, the World Wide Web excels at a class of applications that involve the one-to-many publishing of public documents. The straightforward nature of "broadcast" applications lends them to the generic use of so-called "shareware" client and server software. Investments by third parties in the Web's forms-based metaphor are largely aimed at a set of transaction processing (i.e. electronic commerce) applications. Notes, on the other hand, excels in a broad class of business process applications that require ongoing action by some or all participants and in which the state of data as it moves through the process is

as important as the data itself. The complex nature of these applications tend to require a highly sophisticated and customizable environment, such as Notes, which has demonstrated a remarkable return on investment when applied to mission-critical business processes.

Applications that include both types of requirements will naturally benefit from the integration of Notes and the Web, in which information most appropriately gathered and managed by Notes can be easily made available to the large population of Web users, and, in turn, an event triggered by an activity on the Web can quickly become part of a non-public business process.



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The fax machine and the copy machine are at polar opposites on my floor. And the nine people I had to get drafts of my document to? Two on my floor. Three on floors you'd be embarrassed to take the elevator to. And four not even in this office.

How I walked four miles in a 9,000 square foot office.

And then I had to get each draft back with comments, and incorporate those comments into my document by the following morning. So I basically faxed and copied and delivered and then typed and re-typed and re-faxed and re-copied and re-delivered



until my feet hurt and my legs were tired and I was sitting there starting to wonder why the heck running shoes aren't considered standard business attire.

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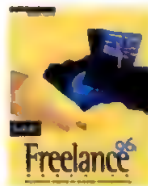
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COLLEGIATE HEALTH CARE & NETIMAGE



Because of Lotus Notes, Collegiate Health Care, based in Norwalk, Connecticut is able to operate as a national company and provide its customers with better service.

In 1993, NetImage, a Lotus Business Partner, implemented Lotus Notes for Collegiate Health Care. Notes has allowed Collegiate to operate as a "virtual" company. According to Collegiate Health Care's CEO Brett Prager, "Becoming national became 'real' more quickly than expected because of the technology." Since this installation, Collegiate has been able to hire the right employees based on skill and experience rather than what state they live in.

Notes allows Collegiate employees located in regional offices throughout the United States to communicate via E-mail through Notes. The sales force is more productive because their communication is quicker and more frequent. And, Notes databases allow sales managers to track sales as they are happening. Data can now be accessed by all company mem-

bers. Prior to the Notes installation, data was stored on each individual's system and documents were passed from person to person. Notes now provides access to databases that allow users to share information simultaneously.

Collegiate has also been able to increase its effectiveness in servicing its customers in university health care centers, who outsource their health care facilities to Collegiate. Direct lines of communication between Collegiate Health Care and the university health centers have been opened and have accelerated business processes. In the fall of 1995, with the help of NetImage, Collegiate plans to roll out Notes to the medical practitioners. They will use Notes applications to schedule and track patients. Specific Notes applications have been developed by NetImage for the health care centers and have been instrumental in Collegiate Health Care gaining new business.

"We are using Notes to radically change health care by taking what has been a traditionally expensive system and making it affordable to the common man," Prager said.



SYSTEM INTEGRATION (Continued)

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Brookfield CT 06804
(203) 775-3445
Dale Whitney



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Getting Started Developing Lotus Applications.

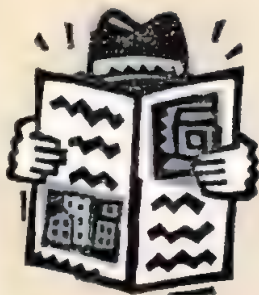
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First Looks

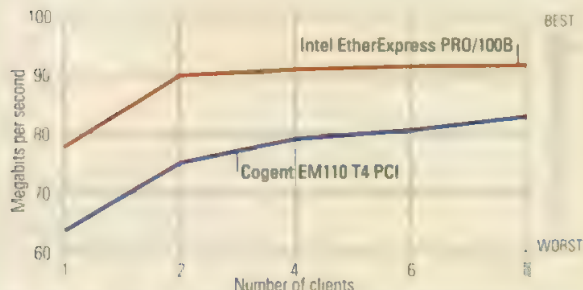
HANDS-ON REVIEWS OF NEW SHIPPING PRODUCTS

FAST ETHERNET

Fast Ethernet's T4 Zooms In

Fast Ethernet T4 Solutions

We compared the performance of the Cogent EM110 T4 PCI adapter with that of the Intel EtherExpress PRO/100B, using NetBench's NIC Throughput test with 32K blocks. For each test run, we measured client throughput with one adapter installed in the server and a matching adapter in a client PC.



By Jeffrey G. Witt

When preparing to rev up your LAN, choosing among the numerous high-speed networking options can be baffling. You've got ATM, FDDI, 100VG-AnyLAN, and Fast Ethernet—which comes in many flavors—all competing for attention.

Of those selections, Fast Ethernet has garnered strong support. Particularly popular is the 100Base-T4 technology standard, primarily because the number of products and the dropping cost have made purchasing these adapters an easy choice. Although this decision has been termed a "no-brainer" by many, you should carefully consider both your current infrastructure and the requirements for implementing Fast Ethernet.

The appeal of T4 is that it lets you work with "what you got." T4's ability to work across the installed base of twisted-pair Category 3 cable standards, as well as Category 4 and Catego-

ry 5, give it an advantage over 100BASE-TX products, which work only over Category 5. Compared with the large numbers of TX devices, however, T4 has been slow coming to market. T4 products require a complete silicon development cycle, whereas the leverage of FDDI technology allows quick-to-market TX products.

Whatever option you pick, conducting cable tests and inspecting the configuration of your wire is crucial. T4 requires you to use four pairs of wiring: one for reception, one for transmission, and two for bidirectional activity. In contrast, TX uses two pairs: one for transmission and one for reception. Determining how many pairs were pulled or punched down for installation should be an important item on your decision-making checklist.

If you already have Category 5 cable, make sure that all punch-down blocks fit Category 5 specifications. Specific T4 and TX

hubs or switches are required for each technology and don't operate with one another. Further backbone considerations include TX and FX duplexing, which would provide transmission speeds of 200 Mbps; T4 products will not duplex.

Cogent Data Technologies EM110 T4 PCI and S-1200 T4 Repeater

Wish you could update your current network speeds without disruptive or costly rewiring? Your wish is Cogent Data Technologies' command. Cogent is finally shipping the first of the long-awaited Fast Ethernet

products to adhere to IEEE 802.3u 100Base-T4 standards.

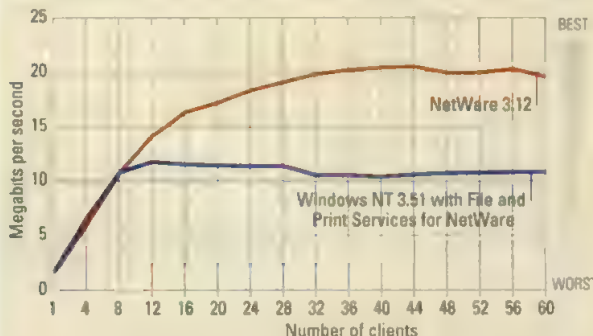
With its offering of the first complete T4 solution, Cogent is blazing the Fast Ethernet T4 trail. This suite allows for 10- or 100-megabit-per-second (Mbps) speeds over common voice-grade twisted-pair Category 3 cabling and Category 4 and 5 standards.

Cogent's product family includes the EM110 T4 PCI adapter, which retails for \$229, and the S-1200 T4 Repeater, which is listed at \$1,998. The repeater is a stackable 12-port hub that can offer as many as 60 connections when used with four more S-1200 T4s. The twelfth port can be configured as an uplink by using the provided MDI/MDI-X button.

To complement these products, Cogent is shipping its

Microsoft's File and Print Services for NetWare

You may remember the Network Edition First Looks review of Microsoft's File and Print Services for NetWare ("Microsoft Makes Windows NT Ready-to-NetWare," January 9, 1996). We've now explored further, using NetBench's Disk Mix test, to determine how FNPWW affects the performance of client PCs.



We connected 60 client PCs to an HP NetServer LS with 128MB of RAM, running NetWare 3.12 and then Windows NT with FNPWW. The two configurations performed about equally with up to 8 clients. But with 32 to 60 clients NetWare proved to be nearly twice as fast as Windows NT with FNPWW.

NETWORK

First Looks

EM440 T4 PCI Quartet adapter, which includes four T4 connections. This is ideal for servers with scarce PCI slots that need network segmentation. The products allow auto-sensing for operation at both 10 and 100 Mbps.

We compared the performance of the EM110 T4 against its 100Base-TX cousin, the Intel EtherExpress PRO/100B, which also happens to be a recent Editors' Choice recipient ("Shifting into High Gear," December 19, 1995). We tested a matched-pair installed with one node and the server to measure client throughput. Though Cogent's product did well, the PRO/100B zoomed a little faster. The Intel adapter offered nearly a 20 percent advantage in performance, with 78 Mbps; the EM110 T4's score was 64 Mbps.

To assess the Cogent adapter as a server adapter, we placed increasing client workloads of up to eight clients to fill a 100-Mbps

pipe. During this test, the EM110 T4 closed the performance gap somewhat, with the PRO/100B outperforming the Cogent adapter by only 10 percent.

Important for server adapters, however, is the ability to keep CPU utilization low, thereby freeing up the system to perform multiple tasks. The EM110 T4 offered the lowest utilization we've seen at a mere 22 percent.

Additional performance gains are possible using Cogent's Predictive Pipelining, which requires all end-to-end connections to be EM110 T4 adapters. Predictive Pipelining signals the server with the size of upcoming packets.

DRIVING T4

Driver implementations are often an ongoing process for T4 adapters, and as the EM110 T4 matures, expect to see improvements that will increase throughput. Our test-bed consisted of an HPLF 5/66 loaded with Novell's NetWare 3.12 connected to

Crosstalk



Gail Shaffer

"These are nice products, Frank. You get very low CPU utilization and the ability to push data at 100 megabits per second without requiring you to spend many thousands of dollars to upgrade to Category 5 cabling. And link lights; we know that everyone likes useful link lights, Frank."

"Cogent did a good job of design, no doubt. But any standard that must have four good wire pairs to each node (that means 100VG and T4) brings its own difficulties. T4 is an interim solution for a fading problem. In most cases, Gail, folks should take the step to Category 5 cabling."



Frank Dorfner

Compaq XL 5100s running DOS VLM 1.2 drivers.

Installing the self-configuring PCI adapter in our server and clients was a snap, as each computer's BIOS automatically set the hardware. Separate LEDs for 10 Mbps and 100 Mbps are provided for information about link status and network activity.

In 100-Mbps configurations, the link status LED blinks continuously to indicate a good link.

Driver installation in the NetWare 3.12 server went without a hitch. The EM110 T4 ships with drivers for NetWare 3.x, NetWare 4.x, and SFT III configurations. README files are included with step-by-step instructions, configuration examples, and updated versions of Novell's NLMs.

Cogent offers an extensive driver set for most popular desktop and network operating systems, which include DOS ODI, Windows for Workgroups 3.11, Windows 95, and SCO Unix, as well as NDIS drivers for both DOS and OS/2. At the time of our testing, Microsoft Windows NT and NextStep drivers were not yet available, but by the time you read this, they should be downloadable from Cogent.

Thorough documentation and diagnostics for troubleshooting round out Cogent's package. No SNMP agents or DMI management schemes are currently available for the adapter, however.

EM110 T4 PCI. List price: \$229.
EM440 T4 PCI Quartet. List price: \$1,298.
S-1200 T4 Repeater. List price: \$1,998. Cogent Data Technologies, Bellevue, WA; 800-426-4368, 206-603-0333; fax, 360-378-2882; support@cogentdata.com. Circle 960 on reader service card.

Check Your Cable

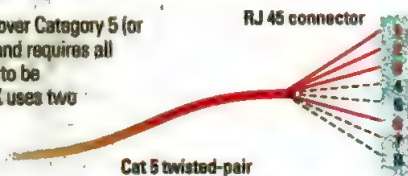
Installation costs are the largest part of cabling expenses. Category 3 plenum cable is priced between 9 and 25 cents per foot, and Category 5 cable is priced between 23 and 37 cents per foot.

100Base-T4 will work over Category 3 UTP voice-grade cable, as well as higher-quality Category 4 and Category 5 cable. T4 hubs are required. Cabling for T4 uses four pairs (pins 1 through 8).



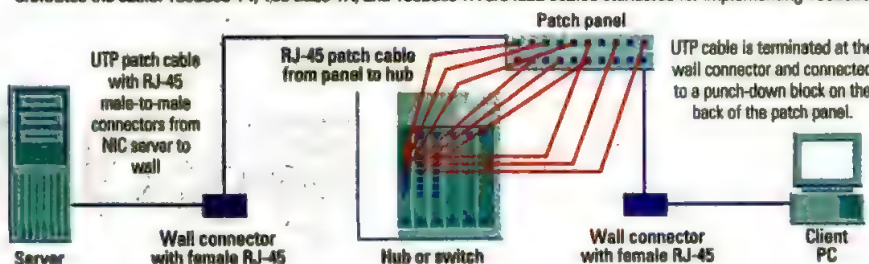
With 100Base-T4, all wires are straight through from end to end. One pair is dedicated for transmission, while one pair is for reception. Two pairs are for bidirectional activity.

100 Base-TX will work only over Category 5 (or Cat 5) UTP data-grade cable and requires all punch-down blocks and hubs to be Cat 5-specific. Cabling for TX uses two pairs (pins 1, 2, 3, and 6).



With 100Base-TX, all wires are straight through from end to end. One pair is used for transmission, and one pair is used for reception. Remaining pairs are unused but should be terminated for future considerations.

100Base-T refers to the way the cable is used. CSMA/CD (carrier sense multiple access/collision detection), like 10Base-T, arbitrates the cable. 100Base-T4, 100 Base-TX, and 100Base-FX are IEEE 802.3u standards for implementing 100Base-T.



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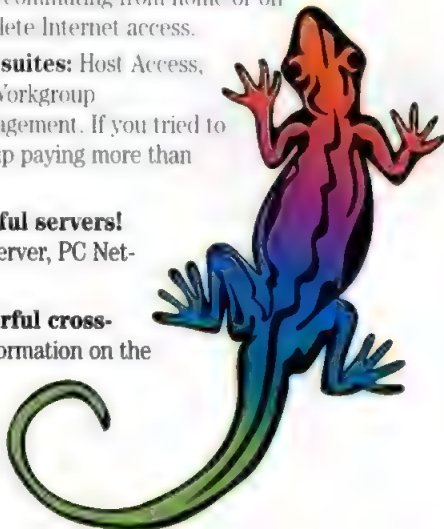
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Chameleon Desktop also includes six powerful servers! NFS Server, FTP Server, Web Server, Directory Server, PC Net-Time Server, and Domain Name Server.

Chameleon Desktop applications offer powerful cross-functional integration – drag-and-drop any information on the network between applications at the click of a button.

Chameleon Desktop includes WinSock TCP/IP and is 100% DLL/VxD. Chameleon requires only 6KB memory and sets up in five minutes.



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CIRCLE 877 ON READER SERVICE CARD

NETWORK EDITION

First Looks

NETWORK DESIGN PROGRAMS

NetSuite Knows Networks

By Robert P. Lipschutz

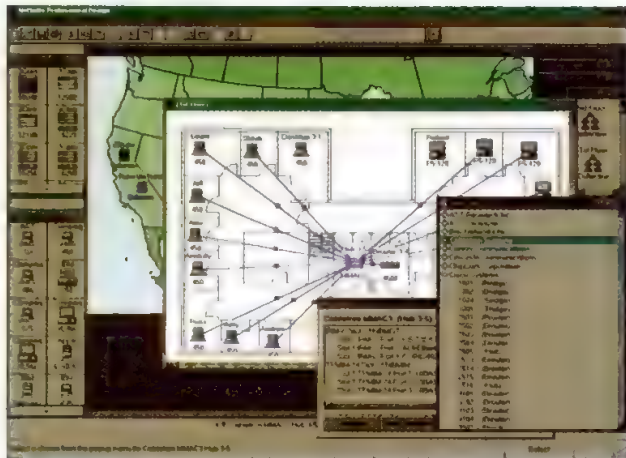
Though NetSuite Professional Design may appear to be a simple network drawing program, within its seeming simplicity lies powerful functionality. For under \$1,000, network designers and consultants can purchase a tool that will assist with planning, designing, validating, and upgrading multivendor networks.

This software makes available product information and network-design skills previously known only to experienced network engineers. NetSuite's primary weakness is that though it derives its power from simulating specific branded products, it lacks a complete product database. Although more than 1,500 specific devices are supported, many devices were not in NetSuite's database.

This product's main advantage over other drawing programs is its smart icons, which can be dragged from either the global device database or user-defined product templates and dropped onto the network de-

Each icon includes intimate information about the product being emulated, such as the maximum number of ports, connector types, and protocols supported. Whereas most drawing programs simply listen to you for information, NetSuite actually talks back. For example, an Asanté Hub 1012 port 10Base-T Ethernet hub device will not let you connect a thirteenth computer: The icon will turn bright red in the process and prevent you from connecting a single Token-Ring computer.

The best place to start your network design is with a logical view of it. Using NetSuite's background maps and floor designs or imported versions of your own, you can set up an appropriate backdrop for your network. NetSuite also provides collections, or additional groupings, which can take the form of a city, a building, or even a wiring closet. These hierarchical logical groupings will help house and organize the network devices you add later to describe your network.



MAPPED OUT: NetSuite presents your network topography in a familiar map metaphor.

sign sheet. The icons simulate real devices you might find on a network, such as desktops, servers, hubs, and routers.

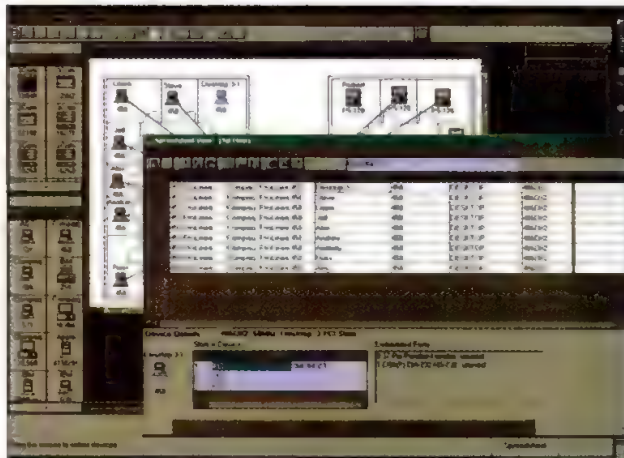
NetSuite's strength shows when you place the smart devices in your logical structure. During testing, we populated

our network with Cabletron and 3Com hubs, Cisco routers, Kalpana Ethernet switches, and Compaq desktop computers and servers.

We added Intel Ethernet adapters to some of our desktops and servers and populated others with 16-Mbps Madge Token-Ring adapters. Then we

Although NetSuite has a good collection of products from the major vendors, such as Bay Networks, Cisco Systems, and 3Com, it doesn't cover the entire product lines of these companies. Some smaller companies are absent altogether.

NetSuite plans to respond quickly to specific customer re-



GREAT SELECTION: Though NetSuite has some work to do yet, the catalog of products is extensive.

connected it with the UTP and fiber cable in our network. NetSuite was smart enough to know which Cabletron hub module was required for a fiber connection across the building.

NetSuite's computer icons also contain information about the CPU and expansion slots and let you add compatible network adapters to the PC. The Cabletron MMAC chassis-based hubs provide a good example of this functionality at work. For those of you who have used these hubs, you know they're rife with module options. NetSuite knows exactly which modules fit in which port, and reading the choices is much like reading a Cabletron product catalog.

Once we were done, we printed out the work orders and bill of materials. NetSuite also has a series of canned reports and a spreadsheet view that can provide even more information about your network.

Again, NetSuite's biggest flaw was the lack of some important devices in its database.

quests and said it will post new devices on both a quarterly CD and its Web server. A subscription fee of \$295 gives you a one-year membership for updates.

We also found some fairly typical Version 1.0 user interface problems in NetSuite. For example, some of the windows were a bit awkward to use. The Quick Look box, which has useful information about each device, does not have a sizable window; this forces users to scroll from left to right to see all information.

All in all, we were impressed. If NetSuite continues to add devices to its repertoire, this will soon become a tool every network administrator should have.

NetSuite Professional Design, Version 1.0. List price: \$995 (includes single user license); NetSuite Library subscription, \$295 a year. NetSuite Development, Wayland, MA; 800-638-7848, 508-647-3100; fax, 508-647-3100; <http://www.netsuite.com>. Circle 959 on reader service card.

First Looks

ISDN ADAPTERS

Bit by Bit, ISDN Gets Easier

By Les C. Freed

The time for you to push for ISDN may have finally arrived, thanks to Motorola's \$375 BitSurfr Pro ISDN termi-

popularity, ISDN service is now as easy to order as POTS (plain old telephone service) in many areas. True, there are hundreds of bewildering configuration op-

nondigital calls to either or both of the POTS lines. This lets you enjoy the two-lines-on-one benefits of ISDN without spending several hundred dollars on an ISDN telephone. It also lets you use two separate numbers on a single ISDN line.

The rear panel of the modem-size BitSurfr Pro is crammed with connectors. An RS-232C interface connects the BitSurfr Pro to your PC, an 8-pin RJ-41 jack connects to your ISDN line, and two RJ-11 jacks connect to your legacy phone equipment. Six LEDs on the front provide status information, showing the state of each POTS port, the ISDN line, and the data link.

The BitSurfr Pro doesn't have a power switch; it is intended to operate as an ISDN-to-POTS bridge 24 hours a day. If you're going to rely on the BitSurfr Pro for all of your telephone service, plugging it into an uninterruptible power supply would be wise.

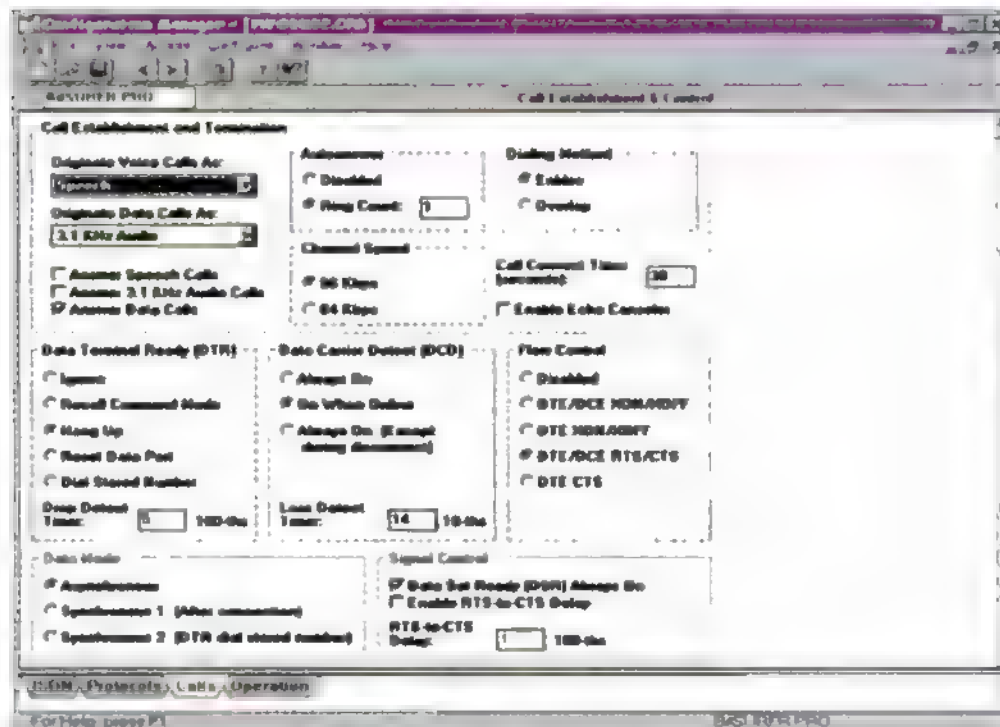
As an ISDN adapter, the BitSurfr Pro uses one or two B-channels at 56 or 64 Kbps. The unit supports clear channel, V.120, Point-to-Point Protocol (PPP), and multilink PPP connections, so you can

generating a dial tone and ringing signals internally.

Because RS-232 cables can be no more than a few feet long, the BitSurfr Pro must reside close to your computer. If you want to use the BitSurfr Pro to supply telephone service to several telephones scattered around your home or office, you'll need to connect the BitSurfr Pro into your existing telephone wiring.

Motorola warns that the total ringer equivalence on each POTS line must not exceed 2.0. Newer telephones generally have very low ringer equivalence numbers, so this shouldn't be a problem for most users.

We tested the BitSurfr Pro with Spry's Internet-in-a-Box, CompuServe's WinCIM, and Windows 95's dial-up networking software. All worked without a hitch. The BitSurfr Pro comes with terminal emulation, serial-port enhancement, and Internet access software, including Hilgraeve's HyperAccess Lite, NetManage's Internet Chameleon 4.5, and Pacific CommWare's TurboComm/2 communications drivers for Windows 3.x. A coupon is also enclosed for two copies of DataBeam's



PLACE YOUR ORDER: Motorola has made ordering ISDN a series of easy steps in BitSurfr Pro.

nal adapter. If you've been putting off switching your home- or small-office phone service to ISDN, this product has enough going for it to argue away your excuses. It's inexpensive, lets you hold on to and use your legacy telephone system, and simplifies configuration.

Many potential users have passed up ISDN's main advantage—reliable 128-kilobit-per-second data connections—because of horror stories they've heard from ISDN users. These stories tend to have three recurring themes: ISDN service is expensive or too difficult to order, the equipment is bulky and pricey, and ISDN requires you to buy new (and expensive) digital telephones.

Motorola has heard all this before and apparently has listened. With some help from regional phone companies, Motorola has carefully addressed each of the problems, and this is clear in the quality of the BitSurfr Pro.

First, because of its increasing

tions, but Motorola supplies an easy-to-understand form that guides you through ordering ISDN service.

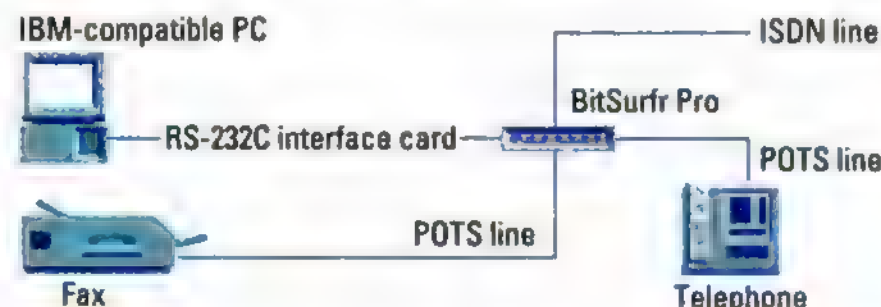
Second, this equipment is neither bulky nor expensive. Installing the BitSurfr Pro is merely a matter of plugging in a few cables; configuration is handled by the provided Microsoft Windows-based Configuration Manager. If you're using Microsoft Windows 95, the BitSurfr Pro provides plug-and-play compatibility. And it may even save you money in another way. Because ISDN provides the equivalent of two telephone lines, having one ISDN line is often cheaper than having two POTS lines.

Finally, the BitSurfr Pro brings you into the digital world of ISDN without requiring you to discard your existing analog phones, answering machines, and modems.

Two POTS ports on the BitSurfr Pro allow you to connect anything with an RJ-11 plug. The Configuration Manager lets you assign incoming

Adapting Made Easy

The BitSurfr Pro, which is about the size of your average modem, connects to your PC through the RS-232C interface card. Then you can connect both your ISDN line and your legacy POTS line to the BitSurfr Pro, so you don't have to toss out your old system.



use it with almost any ISDN dial-up service.

When you pick up the telephone attached to one of the POTS ports, you hear a dial tone, even though ISDN lines don't have dial tones. The BitSurfr Pro acts like a small telephone-company central office,

FarSite document conferencing software.

BitSurfr Pro. List price: \$375. Motorola Inc., Huntsville, Alabama; 800-451-2369, 205-430-8000; BBS, 508-261-1058 (analog), 508-337 7304 (ISDN); <http://www.mot.com/MIMS/ISG/>. Circle 951 on reader service card.

NETWORK EDITION

First Looks

MASS STORAGE DEVICES

Xistor More Without RAIDing Your Budget

By Steve Rigney

More, more, more seems to be one of the latest networking mantras, and one that is often repeated when it comes to storage. As applications, operating systems, and data files get larger, many network administrators are faced with the task of adding disk space to their file servers and client PCs. And this usually isn't easy or cheap.

Adding a new internal hard disk isn't always simple, because of a lack of space, too few power connectors, or other limitations. And external hard disks can be equally frustrating. They're usually large, expensive, difficult-to-install RAID subsystems or smaller optical drives that lack the necessary performance for most applications.

In an effort to offer an affordable external hard disk subsystem with excellent performance, the folks at Xistor have developed the dd.400. The dd.400 is a hot-swappable, removable disk subsystem that you can configure with one or two Seagate or Micropolis SCSI hard disks with a storage capacity of 500MB to 8.5GB. It has a retail price of \$395 for the Dual Docking Station, \$1,599 for a single 2GB disk container, and \$5,995 for two 8GB hard disks.

If you need to add up to 17GB of storage space to a client PC or file server but don't have the money to invest in a large RAID subsystem, this product is ideal for your situation. The disks are hot-swappable and housed in a sturdy case, so you can easily share them with other local or remote dd.400 users, which is a useful—even crucial—feature.

The dd.400 can be connected to any file server or client PC

that is equipped with a SCSI controller; Xistor doesn't currently offer any RAID software, however. You'll have to rely on the SCSI controller or operating system for that feature. At present, the dd.400

ing the SCSI ID of your disk drives.

The disk drives are housed in a small metal container that includes a handle and slides onto the hard disk chassis. Because the unit is made of metal, it's quite durable and will protect your disks from common accidents, such as falling off the shelf.

Most external subsystems contain hard disks that are stacked vertically on top of one

almost any SCSI adapter, but you'll get the best performance with a 32-bit PCI or EISA controller. During testing, we connected the dd.400 to an Atto Vantage PCI-SC SCSI controller in a Gateway 2000 P5-75 server running NetWare 4.1.

We used the built-in NetWare RAID Level 1 option to mirror a single volume across both of the disks. We were able to remove one of the disks during normal operations and noted that NetWare automatically switched to a remaining drive without any downtime.

Most of the cable in the dd.400 is held internally in the chassis, but you will have to provide the SCSI cable to connect your drives to your controller. And before you can purchase the proper cable, you'll need to know what type of connector is on your SCSI controller. (Xistor will supply you with the proper cable.)

The dd.400 does have some direct competition: Storage Dimensions also offers a two-bay, hot-swappable disk subsystem, called the MiniFlex. But its street price of \$725 for just the chassis makes it a more expensive option than the dd.400.

The MiniFlex does have one feature that gives it a definite advantage: It allows for insertion of both SCSI disk drives and 4-mm DAT drives into the chassis. The folks at Xistor are also working on a 4-mm DAT drive, which they say should be available by the time you read this.

Before the dd.400 becomes a perfect solution for adding storage to your file server, the developers at Xistor need to add more options. A bundled SCSI adapter with RAID and management software are two of the most crucial ones currently missing.

dd.400. List price: Docking station and one 2GB disk container, \$1,599. Xistor, Reno, NV; 800-947-8671; fax, 702-825-3016; xistor@xistor.com. Circle 952 on reader service card.



SPACE AGE: The design of the dd.400 may seem futuristic, but it's a sturdy unit.

doesn't include any management software either.

Another weakness we encountered was that Xistor didn't supply us with an external SCSI terminator. The next version of the dd.400 will include automatic switchable termination, but for now you'll need to use a 68-pin high-density SCSI terminator if the dd.400 is the last device on your SCSI bus.

One of the first things you'll probably notice about the dd.400 is its unusual space-age design. The unit consists of a 5.8- by 10-inch chassis that contains two SCSI ports, a power supply, and switches for chang-

another, but the dd.400 uses a unique horizontal design in which the drives are placed side by side. Xistor's developers claim that the horizontal design is better for cooling the device. Though this horizontal design looks nifty, it prevents you from stacking multiple dd.400 chassis.

Currently, the dd.400 offers only a single Fast/Wide SCSI-2 interface. Future versions will allow you to split the bus so you can connect each hard disk to a separate controller or a single dual-channel controller. This change will allow you to duplex your disks.

The dd.400 will work with

NETWORK EDITION

First Looks

CD-ROM SERVERS

Share and Share More

By Steve Rigney

So you want to share CD-ROMs over your Microsoft Windows NT network. No problem, right? Well, it depends on how much sharing you want to do and how you want to manage it. Though Windows NT has perfectly decent CD-ROM-sharing abilities, if you want to do more, you may need to look elsewhere.

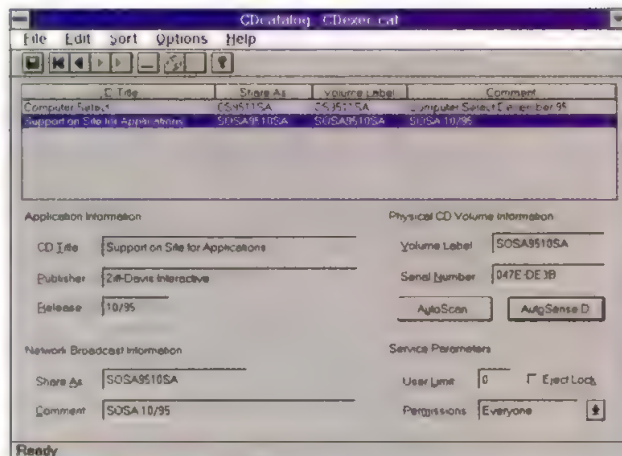
Enter Logicaft Information Systems with its CDexecutive 1.1. With this product, the company joins Meridian Data in a burgeoning category: CD-ROM servers for Windows NT.

CDexecutive, which sells for \$1,495, runs on a Windows NT

server and allows you to do everything CD-related that Windows NT can but adds management capabilities as well. Logicaft also offers a souped-up version, CDexecutive/Plus, which is available only preinstalled with Windows NT on Logicaft's CDworks and XF servers.

With Windows NT, you can share CD-ROM drives as volumes on your network, but management options are lacking. You can't manage your server-based CDs from a remote location, and you can't keep a database of the different CD names.

Though it's true that unless



DRIVING THE CATALOG: Creating and maintaining a log of CD-ROMs used by the server is CDcatalog's job.

you have multiple CDs that need powerful scheduling and grouping capabilities, Windows NT probably offers all you need. But if you need or want more,

CDexecutive has the functionality to make CD-ROM-sharing everything it can be on your Windows NT network.

CDexecutive has the func-

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First Looks

tionality listed above, and it lets you automatically mount and dismount CDs, launch CD-based applications when the disk is inserted, and create and run script files for transparent access to the CDs.

This product is also extremely easy to set up and use. You don't have to worry about SCSI drivers and other hardware issues, because CDexecutive uses Windows NT's built-in functionality. And its ability to work with Macintosh, NetWare, and Windows NT clients ensures that CDexecutive fits nicely into most heterogeneous networks.

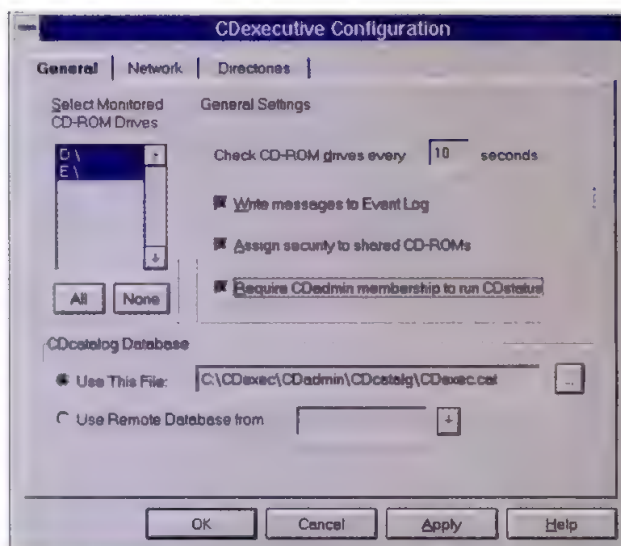
CDexecutive is not a single Windows NT application but several grouped into three main components: CDexecutive Server Software, CDexecutive Management Center Software, and CDexecutive User Software. These applications work together to allow you to share and manage multiple CDs installed on your Windows NT server.

Any Windows NT client, including Microsoft Windows for Workgroups and Microsoft Windows 95, can access CDs in the same way as a network volume. You can also add Microsoft's File and Print Services

client/server applications, the CDexecutive server software runs as a 32-bit background service. The CDexecutive server automatically polls your CD-ROM drives to look for any new CD titles. When it finds a CD, it scans the CDexecutive database.

The CDexecutive database keeps track of new and existing CDs, including information such as the drive letter each CD should be mounted under, the title of each CD, and even any comments or publisher information. If the CDexecutive server finds the information on the inserted CD, it will automatically mount the CD and map a drive letter. If the CD has never been used before, you will need to add the CD information in the database. Microtest's DiscPort (reviewed in "Serving From a Silver Platter," January 9, 1996) is a competing product for NetWare that includes many of the same database features.

The CDexecutive management center consists of four applications: CDcatalog, CDstatus, CDscript, and the optional CDmeter. As we explained earlier, the CDcatalog creates and maintains a catalog of CD-ROMs used by the CDexecutive server. CDstatus displays



OFF AND SPINNING: Configuring your system to use CD-ROMs is quite easy with CDexecutive.

client PC as long as 32-bit Windows software is installed. During testing, we successfully installed the CDstatus utility on a client PC running Windows NT, Windows 95, and Windows for Workgroups. In addition to monitoring CDs, you can perform other tasks, such as ejecting the CD from the drive.

With the CDscript utility, you can create a library of CD-ROM command files. These command files are similar to DOS batch files and let you

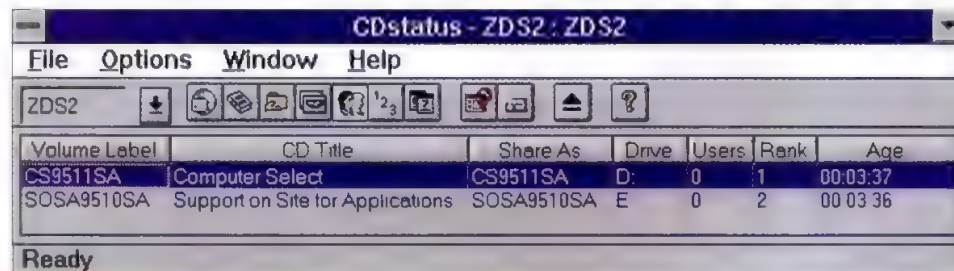
include any canned scripts, if you know basic DOS commands, you shouldn't encounter any problems.

CDmeter is available only with CDexecutive Plus, but it's a nice feature if you are concerned about user licenses. Similar to other application-metering programs, such as McAfee's SiteMeter, CDmeter allows you to control and monitor the number of users that can access each CD.

The CDexecutive user software is a set of two applications, CDlaunch and CDgroup, that run on the client PC. CDlaunch enables the end-user to start a CD-ROM application by double-clicking a specific icon.

The user doesn't have to know where the CD is located or to what drive letter the CD volume is mapped. You can use CDgroup to create customized application groups on your desktop. For example, you can easily create an entire group of programs linked to multiple CDs installed on the Windows NT server.

CDexecutive 1.1. List price: \$1,495. Logicraft Information Systems Inc., Nashua, NH; 800-880-5644, 603-880-0300; fax, 603-880-7229; info@logicraft.com. Circle 956 on reader service card.



INFORMATION, PLEASE: The CDstatus application is charged with keeping track of the status of the CD-ROMs attached to the server.

for NetWare (FNPW) and Services for Macintosh to allow all of your NetWare clients and Macs to access the CDs. Unfortunately, CDexecutive and Windows NT do not currently work with CDs that use the Macintosh HFS file format; they work only with those using the ISO 9660 format.

Similar to most Windows NT

the status of all the CD-ROMs attached to the Windows NT server. The CDstatus screen provides you with information such as the network volume label, CD title, share name, drive letter, number of users, and even age of the CD.

Fortunately, CDstatus runs as a Win32s application, so it can run on any Windows-based

launch an application that resides on a particular CD just by selecting an icon.

During testing, we created a script that automatically mounted a CD, mapped a drive letter to the CD, changed to a particular subdirectory on the file server's hard disk, and ran an application on the CD. Though CDexecutive doesn't

New & Improved

NEWS OF ANNOUNCED PRODUCTS AND UPGRADES

By Eryn Brown and Robert Daly



Aviator: Wireless in The Office

MORE AND MORE, COMPANIES are looking into wireless solutions as a means of connecting users within their offices. Momentum Microsystems has introduced the **Aviator** wireless adapter, which uses the unlicensed 902- to 928-MHz radio band.

At \$249 for a two-user starter kit, the Aviator lets you connect up to 32 users at distances of up to 75 feet—providing greater transmission distances than many infrared products. It can communicate at speeds of about 150 Kbps, and it facilitates file transfers and peripherals sharing. The Aviator ships with its own networking software.

Momentum Microsystems Inc. Colorado Springs, CO; 719-540-8338; fax, 719-540-8361; <http://www.mmicro.com/momentum/>. Circle 961 on reader service card.

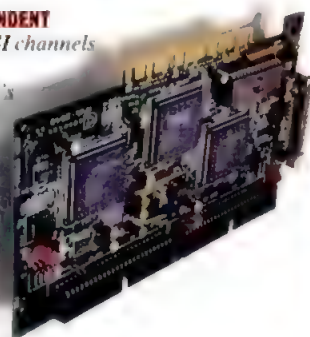
Adaptec RAID Family Grows with AHA-3985W

OPTIONS FOR SETTING UP EFFECTIVE RAID BACKUP AT A REASONABLE PRICE ARE proliferating. Adaptec HAS expanded its RAID family with the recent introduction of the **AHA-3985W MultiChannel RAID Adapter Kit**, which sells for \$849 and provides RAID services for 8- and 16-bit Fast/Wide SCSI devices.

The AHA-3985W uses a PCI-to-PCI bridge to connect devices and a dedicated RISC coprocessor to off-load your server-host processor. It can provide RAID levels 0, 1, 0/1, and 5, and works with Novell NetWare 3.11, 3.12, and 4.x. You can connect up to 45 peripherals using the controller—without losing performance or signal integrity. The AHA-3985W also employs SCSI command chaining, which lets you run multiple I/O commands without burdening your host processor.

Also new to Adaptec's product line is the **Adaptec CI/O** software, which can run on any networked client and provides network management and monitoring for SCSI peripherals attached to Adaptec host adapters. **Adaptec Inc.** Milpitas, CA; 800-442-7274; <http://www.adaptec.com>. Circle 962 on reader service card.

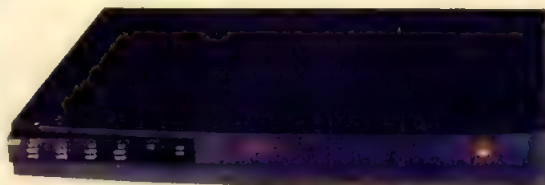
THREE INDEPENDENT RISC-to-SCSI channels boost the AHA-3985W's performance.



HOT PROSPECT

MAX 1800: A Remote Access Switch for Smaller Installations

As telephone companies gradually improve ISDN availability, increasing numbers of modestly sized installations are turning to that technology in their implementation of remote access solutions. Ascend Communications is rolling out a new remote access switch, the **MAX 1800**, aimed at the needs of these smaller businesses.



The switch, though priced lower than its older MAX siblings (\$6,400 for S/T interfaces and \$7,200 for U interfaces), provides advanced functionality. In addition to supplying integrated ISDN, Frame Relay, and modem services, the MAX 1800 has eight BRI ISDN ports through which it can support 16 ISDN B-channels or 16 V.34 modems.

Since the MAX 1800 is modular, it's easy to add more advanced features. If you want to transmit multimedia over your ISDN connections, you can plug in any of the MAX product line video-on-demand cards, all of which are compatible with the switch. Other optional modules provide modem support and terminal-server functions.

Ascend Communications Inc., Alameda, CA; 510-769-6001; fax, 510-814-2300; <http://www.ascend.com>. Circle 963 on reader service card

Matrox Joins The Race

EVERYONE IS LOOKING forward to the day when videoconferencing programs are a common sight on desktop PCs. Hoping to bank on its experience in video technology, Matrox now offers network products it says were designed with videoconferencing applications in mind.

At \$129, the **Darter-10** is a PCI adapter with a full-duplex Ethernet port. It complies with plug-and-play standards and works with all of the major network operating systems. The company is also shipping other interface and hub cards—some of which provide Fast Ethernet operation—as well as stackable hubs and switches.

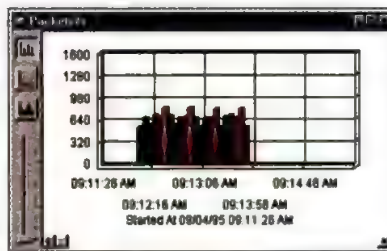
Matrox Networks. Dorval, Quebec, Canada; 514-685-2630; fax, 514-685-2853; <http://www.matrox.com>. Circle 964 on reader service card.

New & Improved

NetXRay Update Available

DELIVERING A QUICK FOLLOW-up punch to its introduction of the NetXRay protocol analyzer at NetWorld+Interop, Cinco Networks has announced the release of **NetXRay 1.1**. The update, which starts at \$995, has a new interface and adds Windows NT support to NetXRay's native Windows 95 support. The

package also analyzes Token-Ring and 100VG AnyLAN networks and features enhanced support for the DECnet, IP, IPX, and SNA protocols. **Cinco Networks Inc.**, Atlanta, GA; 800-671-9272, 770-671-9272; fax, 770-390-9947; <http://www.cinco.com>. **Circle 965 on reader service card.**

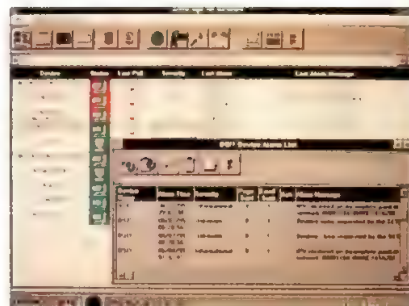


CINCO'S PROTOCOL ANALYZER has graphs for an instant view of network traffic.

A New GUI for AlertPage

REPAIRING THE damage caused by a network failure depends on knowing its extent. Denmac Systems has updated **AlertPage**.

Version 2.0 starts at \$199 and runs on NetWare 2.x, 3.x, and 4.x networks. Able to monitor any IP or IPX device, it provides a status icon on the screen. AlertPage 2.0 also lets you ping devices and send the output report to an alphanumeric pager or e-mail address. **Denmac Systems Inc.**, Northbrook, IL; 708-291-7760. **Circle 966 on reader service card.**



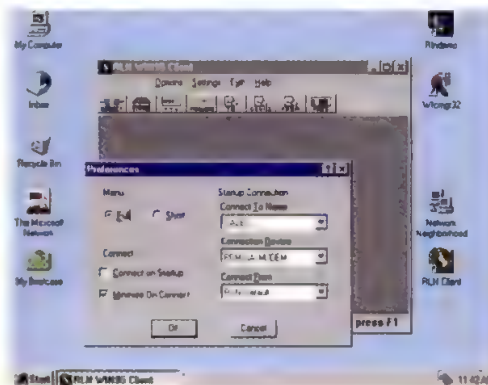
A WATCHFUL EYE: AlertPage 2.0 sends alarms for failures and logs them in a database.

Attachmate Offers New Windows 95 Remote Client

EVEN IF YOUR OFFICE HASN'T MADE THE BIG SWITCH, you can still take advantage of Windows 95 when you dial in from home. Attachmate Corp. is now shipping a **Windows 95 client** for its popular **Remote LAN Node (RLN) 4.0** server package.

Free with RLN 4.0 or EXTRA! Personal Client 6.0, the Windows 95 client can work with any network protocol that supports the NDIS plug-and-play interface—at press time, DLC, IP, IPX, and NetBEUI. (The remote-access client that comes with Windows 95 can work only with IP and IPX.) When used with EXTRA!, Windows 95 can connect to apps running on almost any platform.

The client works with Windows 95's TAPI and UNIMODEM drivers; it also incorporates all of the RLN 4.0 security features, including CHAP encryption for user IDs and passwords, and compatibility with Attachmate's Remote Security Adapters. You can get a



THE WINDOWS 95 CLIENT for Attachmate's RLN 4.0 is now available, free of charge.

copy by calling Attachmate, or you can download the software from the company's BBS or FTP site.

Attachmate Corp., Bellevue, WA; 800-426-6283, <http://www.attachmate.com>. **Circle 967 on reader service card.**

BRIEFS

Hardware

Asanté has released its **PC Edition of the AsantéFast 10/100 Adapter** for PCI (\$159 and up). The adapter, targeted at mixed platform environments, offers a plug-and-play installation, four LEDs for troubleshooting network diagnostics, and support for NWAY Auto-Negotiation. 408-435-8388 **IBM** has announced the availability of four new 2210 router modules with accompanying software. The quartet of products supplies a mix of single and dual Ethernet and Token-

Ring ports as well as support for Frame Relay and ISDN. 919-254-1128 **Rockwell Network Systems** has unveiled its **2340-TX Multiport Adapter** (\$895). The adapter has four 10/100-Mbps Fast Ethernet interfaces on one card that requires a PCI local bus slot. It provides full duplex operation for a maximum bandwidth of 800 Mbps. 800-262-8023 **Server Technology** launched a new version of its **Remote Power ON/OFF** that supports Windows 95 (\$170). This product has the ability to shut down the Win-

dows 95 operating system and power down a remote system. For systems that are constantly up, Remote Power ON/OFF periodically reboots the system to prevent lockups. 800-853-1515 **Xylan Corp.** has introduced Token-Ring switching for the OmniSwitch. The **OMNI-5** (\$8,250) works with up to 24 rings, while the **OMNI-9** (\$10,700) works with up to 48. The OmniSwitch also works with Ethernet, FDDI, CDDI, Fast Ethernet, and ATM. It features IP and IPX routing. 818-880-3500.

Compaq Buys NetWorth, Sets Market Plans on Course

BE ON THE LOOKOUT FOR another big player in the network-computing arena. Compaq Computer Corp. has purchased NetWorth, manufacturer of Ethernet and Fast

Ethernet hubs, switching hubs, and network management tools.

Together with Compaq Computer's recent acquisition of Thomas-Conrad and

its development partnership with Cisco, the purchase of NetWorth represents an important step toward Compaq Computer's objective of presenting a complete line of internetworking products.

Compaq Computer Corp. Houston, TX; 800-888-5858; <http://www.compaq.com>. **NetWorth Inc.** 800-544-5255; <http://www.network.com>.

Bay/Concord RMON Deal

RMON MONITORING GIVES you valuable, thorough information that lets you keep up with what's going on in your network. Bay Networks and Concord Communications will work together in 1996 to bring full RMON2 functionality to Bay customers.

Their first product, **Network Health—Bay Dialogs** (starting at \$14,995 for 25 interfaces), is a new member of Concord's Network Health family. The application will track network-level traffic to determine which segments and users on a network generate the most traffic. It will work with the Bay Networks Advanced Analyzer RMON agent.

The newest release to emerge from this partnership, **Network Health—Applications**, will expand Network Health—BayDialog's capabilities to include applications layer reporting. It will be available in mid-1996.

Bay Networks. Santa Clara, CA; 408-988-2400; <http://www.baynetworks.com>. **Circle 968 on reader service card.** **Concord Communications.** Marlboro, MA; 800-851-8725. **Circle 969 on reader service card.**

Multi-Tech, Citrix Join Forces

IMPLEMENTING REMOTE access solutions is not an easy task. Multi-Tech Systems tries to make the task easier with the introduction of two new hardware/software bundles that give you full-fledged communications servers without making you buy additional PCs.

The **MA8CWF/HD**, at \$9,399, consists of a Multi-Tech 486DX4/100 Single Board computer with 32MB of RAM, a Multi-Tech ISI1608 8-port high-speed serial board, an Ethernet interface card, and a 426MB hard drive, packaged together in a MiniArray chassis. The product also incorporates Citrix's WinFrame software, which provides Windows

NT communications-server functionality.

Supporting Windows NT, Windows 95, Windows 3.1, and DOS applications, the MA8CWF/HD works with POTS lines, LANs, WANs, or broadband connections and can interface with ISDN terminal adapters, muxes, and modems.

The **MA8NWC/HD MiniArray**

costs \$7,699. Made up of the same hardware as the MA8CWF/HD, it is preconfigured with Novell's NetWare Connect, and it provides communications services for 8 ports. It works with the Apple Talk, IPX/SPX, and TCP/IP protocols.

Multi-Tech Systems Inc. Mounds View, MN; 800-328-9717. **Circle 976 on reader service card.**

MULTITECH'S MINIBARRAY
products make setting
up a communications
server simple—
and less expensive.



BRIEFS

Software

Cisco is replacing Stampede's Remote Office Remote-node software and Internet suite with its own **CiscoRemote Desktop Software** (\$199 and up). Included in the package are support for IP/IPX over PPP/SLIP, Netscape Navigator, and Euroda e-mail. 415-513-9083. Citadel Computer Systems is offering version 4.54 of the **NetOFF System IV** security application (\$499). Features include an automatic log-off after a specified time of inactivity,

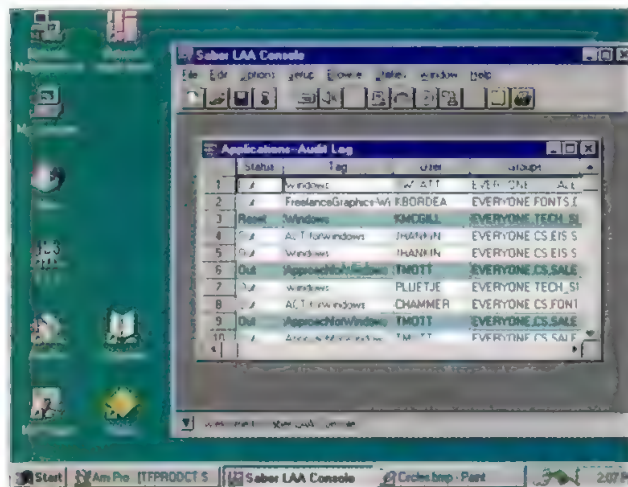
a screen blanker for privacy, and a file saver that will save your current version before closing an application. The package works with Novell networks. 713-686-6400. Interconnections is now including WRQ's **Reflection for Windows, Version 5.0** (\$1,500 and up) in its Leverage Host Services for NetWare to Open VMS connectivity. The bundled package offers bidirectional printing, file sharing, terminal services, and network management. 800-950-5773. Pacific Software Publish-

ing has recently released an upgrade of its personal network notepad, **Openpost** (\$40 and up). Additions include single source support for Windows 3.1x, Windows 95, and Windows NT; single source multilingual support for menus; and dialog boxes and messages. 800-232-3989. Intrusion Detection is shipping the **Kane Security Analyst** for Microsoft Windows NT (\$495 per server). It provides an easy-to-understand security report assessing password strength, access

New & Improved

A New Saber LAN and More

TALK ABOUT ENDING with a bang and not a whimper: McAfee finished out 1995 with a slew of new and updated products.



McAfee is selling **Saber LAN** now. The latest update incorporates new features, in addition to the standard LAN management tools.

First, the company followed up its recent purchase of **Saber Software** with the updated **Saber LAN Workstation (SLW) 5.5**. The LAN management package now features technologies from McAfee and **Saber**. **Saber LAN Workstation** includes McAfee's **SiteMeter** metering and **Site-Express** software distribution tools, the **Net Remote** remote

control module, and the **ServerStor** backup program. A two year subscription costs \$47.40 per node for 1000 nodes.

McAfee also announced an upgrade to the **ServerStor** backup and recovery package (Version 2.0 sells at \$7.50 per node for 1,000 nodes) and several new virus protection prod-

ucts, including **WebScan** (\$65 list price), which prevents you from downloading infected files from the Internet.

WebScan includes its own e-mail and Web browser. It is also compatible with many third-party browsers

McAfee. Santa Clara, CA; 408-988-3832; fax, 408-970-9727; <http://www.mcafee.com>. Circle 970 on reader service card.

Cisco's Windows NT Routing

HOPING TO CAPITALIZE ON ITS large customer base—and on Microsoft Windows NT's growth in the server marketplace—Cisco Systems is coming out with a new routing system, the **CiscoPro CPA1120**. The system, which



THE CISCOPro CPA1120 adapter adds functionality to your Windows NT server.

has hardware and software components, will integrate Cisco IOS features into Windows NT Server, augmenting the OS's native internetworking capabilities. It will sell for under \$2,000.

Included among the features is the Interior Gateway Routing Protocol, which is common to all Cisco products. The hardware portion, an adapter with a co-processor and WAN software, takes over WAN processing functions from the CPU. The routing system will work with the PPP protocol at full T1/E1 speeds.

The CPA1120 will be available during the first quarter of 1996. Future upgrades will supply additional routing protocols and will work with WAN interfaces (including Frame Relay and ISDN). **Cisco Systems Inc.** San Jose, CA; 800-553-6387; <http://www.cisco.com>. Circle 971 on reader service card.

i2i for Low-Cost Video Meetings

TRADITIONALLY, DESKTOP videoconferencing has not been inexpensive. But IPC Peripherals may change that with its \$1,295 **i2i videoconferencing system**. This H.320-compatible hardware/software package includes an encoder/decoder board, a digital video camera, a

telephone handset, and the OLE 2.0-compatible **Win2Win** videoconferencing software.

The encoder/decoder card uses one PCI slot. **i2i** can work over ISDN, T1, Switched 56 communications lines, or Ethernet LANs. The **i2i** system also provides whiteboard functionality, so you can illustrate your arguments as you make them.

IPC Peripherals Inc. Fremont, CA; 510-354-0800; fax, 510-354-0808. Circle 972 on reader service card.

BRIEFS

control, user restrictions, system monitoring, data integrity, and data confidentiality. 212-348-8900.

Announcements

Fabrik Communications, a service provider that connects LAN e-mail systems to Internet e-mail, has added support for Microsoft Mail. Support for cc:Mail became available this past August. 415-986-4933. **Forest Computer** has added support for Windows 95, Windows NT, and NetWare to its Net-

work Resource line of enterprise gateways. PC clients and PC LAN servers will be able to share files and printers with Unix, Digital VAX, IBM AS/400, and IBM mainframe systems. 517-349-4700. **JSB Corp.** released a new software bundle, **Multiview Desktop Plus** (\$315), that includes JSB's **Multiview Desktop**, **Spyglass's Mosaic** browser, and **ICL's e-mail** package, **EMBLA**. This package provides the ability to switch between Windows and Unix applications, browse the World Wide

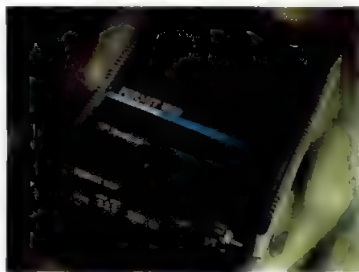
Web, and connect with e-mail systems through the Internet. It also offers terminal emulation, TCP/IP networking data transfer, and remote management through the Unix print utilities. 408-438-8300. **Xircom** and **BreezeCOM** will develop high-speed, multilevel modulation technology to meet the upcoming IEEE 802.11 Wireless LAN standard. By embedding Digital Signal Processing (DSP) in the access point and the adapter, the companies plan to achieve faster data rates. 805-376-9300.

New Security Tools Debut

NETWORK SECURITY IS essential for companies making forays into the Internet. Information Resource Engineering has announced the **SafeNet** product family, which provides transparent security for direct and dial-up Internet connections.

There are three products in the family: **SafeNet/LAN** (\$4,995) is a DES-encrypting hardware firewall that you place between a LAN and its router leading to the Internet. **SafeNet/Dial** (\$695) is a small, portable Encrypting Token that

lets remote users connect to the Internet. The **SafeNet/Certificate Center** (\$54,995) gives you



TIMESTEP'S PERMIT 1060 offers proxy services for up to 256 addresses.

the management and configuration tools you'll need to put it all together.

TimeStep Corp., an affiliate of Newbridge Networks, is also introducing a new security tool, the **Permit 1060 Security Gateway** (\$4,500). The Permit 1060 sits on an unsecured TCP/IP LAN and acts as a proxy agent for up to 256 addresses. It has two Ethernet ports and provides DES encryption at line speeds. The Gateway has an SNMP agent, and can be managed through the Permit 9010 Secure Network Management System.

Information Resource Engineering Inc. Baltimore, MD; 410-931-7500; info@ire.com. Circle 973 on reader service card. **TimeStep Corp.** Kanata, Ontario, Canada; 613-599-3610; http://www.timestep.com. Circle 974 on reader service card.

Page from Your Desktop

THE MOTOROLA PAGING Products Group is introducing **Air Apparent for Windows NT** and **Air Apparent for NetWare**.

The packages let you e-mail messages to any vendor's pagers. Pricing ranges from \$44.95 to \$3,300.00.

Air Apparent is also available as part of **AirPower**, a hardware/software bundle that provides LAN-to-pager server capabilities.

Motorola Inc. Boynton Beach, FL; 407-739-2000; http://www.mot.com/pagers. Circle 975 on reader service card.

MULTIPLE ACCESS By Steve Buehler

TrustNo1



On a recent episode of "The X-Files," FBI agent Scully broke into agent Mulder's computer by guessing passwords. Predictably (for regular watchers of the show), she succeeded with "TrustNo1." Although most of us use more obscure passwords than our personal motto, clearly

the first step in keeping aliens off your network is to pay attention both to the basics and to the specifics of your network needs.

The basics are well documented. We described some in "A Great Server Room," in our issue of January 9, 1996. The firewall products we'll cover in an upcoming issue are another good line of defense against unauthorized intrusion. Beyond implementing secure servers and backup, start by making sure that your NOS's intruder detection is activated and that you enforce regular password changes.

One tool that's very good for helping eliminate gaping security holes in user passwords is **SmartPass** (\$499 per server), a NetWare NLM from e.g. Software (503-294-7025). This utility checks for weak or nonexistent passwords on your network. It alerts you to obvious security flaws, such as a user whose login ID and password are the same. **SmartPass** works well with an assertive NetWare security setup to prevent unhappy employees or mischief makers from walking in the front door of your network.

Another tool is **NetOff** (\$499 for 1 server and 100 users), from

Citadel (713-686-6400). **NetOff** logs users off the network at specified times or after some period of inactivity. The concept isn't new—most screen savers have some form of password protection that starts after some period of inactivity. But **NetOff** lets you define and execute Cleanup Scripts for each of your applications so all open files are closed and applications are shut down elegantly. This approach adds two benefits: Overnight system backups complete without errors (since all open files are closed at the proper time), and unnecessary license fees can be reduced by preventing careless employees from hogging applications they're not using after they leave their PCs.



If you think someone's actually gotten in, **AuditTrack** is the best way to see what's really happening on the network. **AuditTrack** (\$1,195 for 100 users) also was developed by e.g. Software, but it's now available from ON Technology (800-767-6683). **AuditTrack** watches all activity on your network and can isolate information about exactly who is doing what and when. If you think people may be snooping where they shouldn't be, **AuditTrack** can pinpoint the problem by watching every log-on, file access, and supervisory action. Good filtering within **AuditTrack** reduces the potentially huge reports that a busy network could generate. **AuditTrack**, however, is an audit tool, which means it's really focused on

watching and reporting all activity rather than preventing specific hostile actions.

As a network administrator, you've got to help your users practice good security habits. Although no network is absolutely secure, a diligent approach to security, combined with these tools, can reduce your risk. As agent Mulder might say, "The aliens are out there." You need to defend your network with tools like these.



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251	252	253	254	255	256	257	258	259	260
261	262	263	264	265	266	267	268	269	270
271	272	273	274	275	276	277	278	279	280
281	282	283	284	285	286	287	288	289	290
291	292	293	294	295	296	297	298	299	300
301	302	303	304	305	306	307	308	309	310
311	312	313	314	315	316	317	318	319	320
321	322	323	324	325	326	327	328	329	330
331	332	333	334	335	336	337	338	339	340
341	342	343	344	345	346	347	348	349	350
351	352	353	354	355	356	357	358	359	360
361	362	363	364	365	366	367	368	369	370
371	372	373	374	375	376	377	378	379	380
381	382	383	384	385	386	387	388	389	390
391	392	393	394	395	396	397	398	399	400
401	402	403	404	405	406	407	408	409	410
411	412	413	414	415	416	417	418	419	420
421	422	423	424	425	426	427	428	429	430
431	432	433	434	435	436	437	438	439	440
441	442	443	444	445	446	447	448	449	450
451	452	453	454	455	456	457	458	459	460
461	462	463	464	465	466	467	468	469	470
471	472	473	474	475	476	477	478	479	480
481	482	483	484	485	486	487	488	489	490
491	492	493	494	495	496	497	498	499	500

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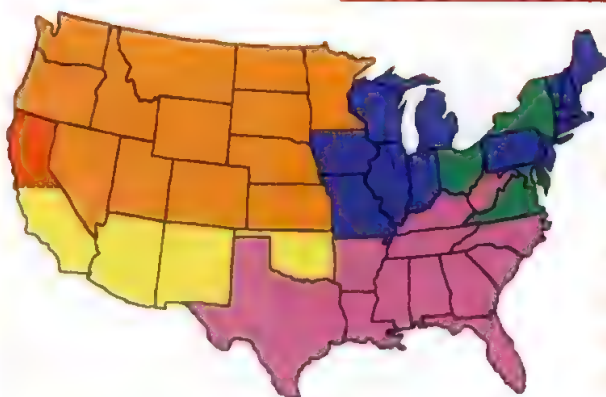
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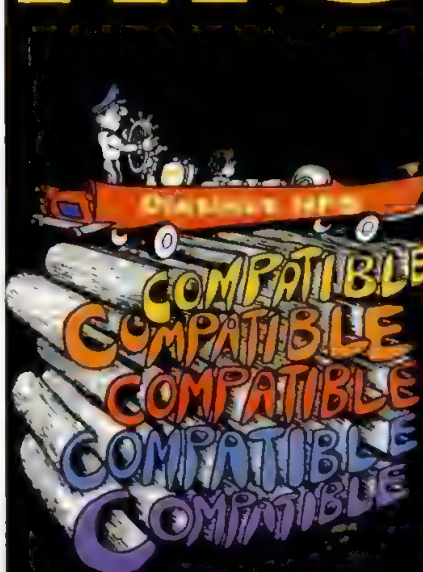
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4,532	21,477
35,767	6,981
52,577	71,270
54,998	99,245
7,449	5,012

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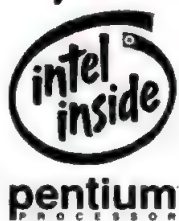
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Whether you're in the market for a high-performance engineering workstation or a speedy new desktop for business apps, Intel has a new chip to fill the bill. PC Labs tests 11 Pentium Pro workstations and 31 150- and 166-MHz Pentium PCs.

THE NEW PENTIUMS

Two Paths to

Call it a case of New Pentium versus Pentium Classic. For the first time in the 15-year history of the PC, the newer and costlier CPU isn't clearly the better choice for mainstream users.

The Pentium Pro (New Pentium) does a great job running the operating systems most of us don't use yet: Windows NT or Unix. On Windows 95, the New Pentium performs about the same, megahertz for megahertz, as a Pentium (Pentium Classic) CPU, despite having an extra 2.2 million transistors of computing power. On Windows 3.1 or Windows for Workgroups, the operating systems still favored by many of the world's business users, the Pentium Pro is actually a bit slower.

What happened? At the start of the decade, when the Intel design

team began work on the Pentium successor (code-named P6), one assumption they were handed was this: By the time the P6 ships in the middle of the decade, the world would be using 32-bit operating systems. So the Pentium, itself just completing design development, would be the last CPU optimized for 16-bit software.

Here it is 1996, and true 32-bit software is still a year or two from widespread adoption. Windows 95 should at best be considered a lite 32-bit OS, because there's

a lot of 16-bit code roaming around inside. And much of corporate America is still working with Windows 3.x.

PENTIUM PRO WORKSTATIONS

In this issue, PC Labs tests the first generation of Pentium Pro systems (those running at 150 MHz, as well as a few early units running at 200 MHz) and the latest iteration of Pentium

PCs (those using the 150-MHz and 166-MHz CPUs released at the beginning of January).

The Pentium Pro serves two audiences immediately:

- First, it provides scorching price/performance when configured as an engineering, CAD, or scientific workstation. The Pentium Pro is a winner in two out of three areas relative to most RISC workstations; raw integer performance is better in many cases, and bang for the buck is superior in all cases. But though the Pentium was a big leap past the 486 in floating-point capabilities, and the Pentium Pro is a leap beyond that, a gap

still remains relative to RISC CPUs.

- Second, the Pentium Pro will soon be the application server platform of choice for many businesses.

Comparably equipped, a Pentium Pro system will cost at least \$1,000 more than a Pentium PC. Some of the cost differential lies in the Pentium Pro CPU itself, which costs \$974 (in quantities of 1,000) for the 150-MHz part, including an integrated 256K L2 cache that would cost extra on a Pentium. But of course they won't be *completely* comparably equipped, because the Pentium Pro is happiest running Windows NT, and Windows NT only begins to come to life with 32MB of RAM. (This advice started out as a running joke, but it turns out to be true: Whatever memory Microsoft says you need, double it, and your PC will run fine.)

NEWER, FASTER PENTIUMS

If you're a mainstream Windows user, you should be looking at the newest

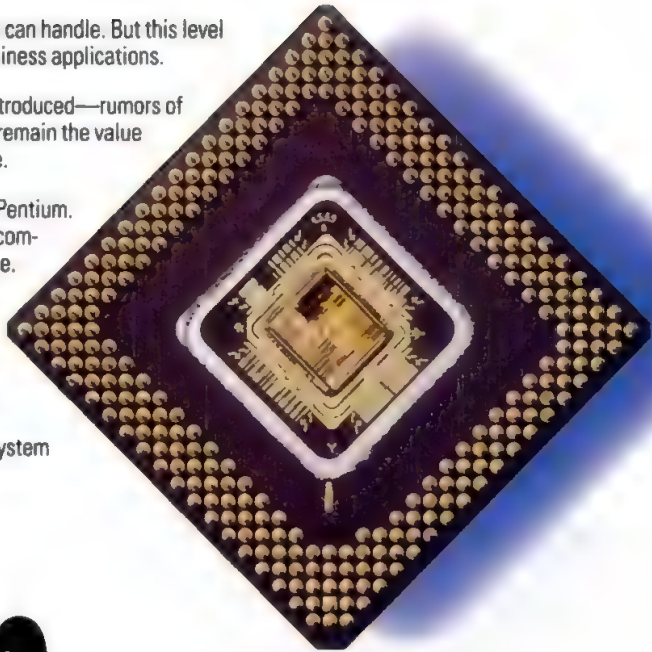
Pentium Processor

TWO INSTRUCTIONS PER CLOCK CYCLE is all that the Pentium can handle. But this level of performance is more than adequate for today's mainstream business applications.

SYSTEM PRICES WILL CONTINUE to drop as faster CPUs are introduced—rumors of 180- and 200-MHz parts are already circulating. Pentium PCs will remain the value choice for mainstream business and home use for quite some time.

WINDOWS 95 IS QUICKLY BECOMING the OS of choice for the Pentium. This processor grew up on Windows and 16-bit applications, and component vendors have responded to demand by optimizing hardware. These vendors are perfecting their Windows 95 drivers, so users can expect even better system performance in the future.

THE BOTTOM LINE: Just because Intel has shipped a new, more powerful processor, don't think that the Pentium will go the way of the dinosaur. This processor will continue to comprise the majority of Intel's processor shipments—and the bulk of overall system sales—through the end of 1996, at the minimum.



Power

Pentium Pro Processor

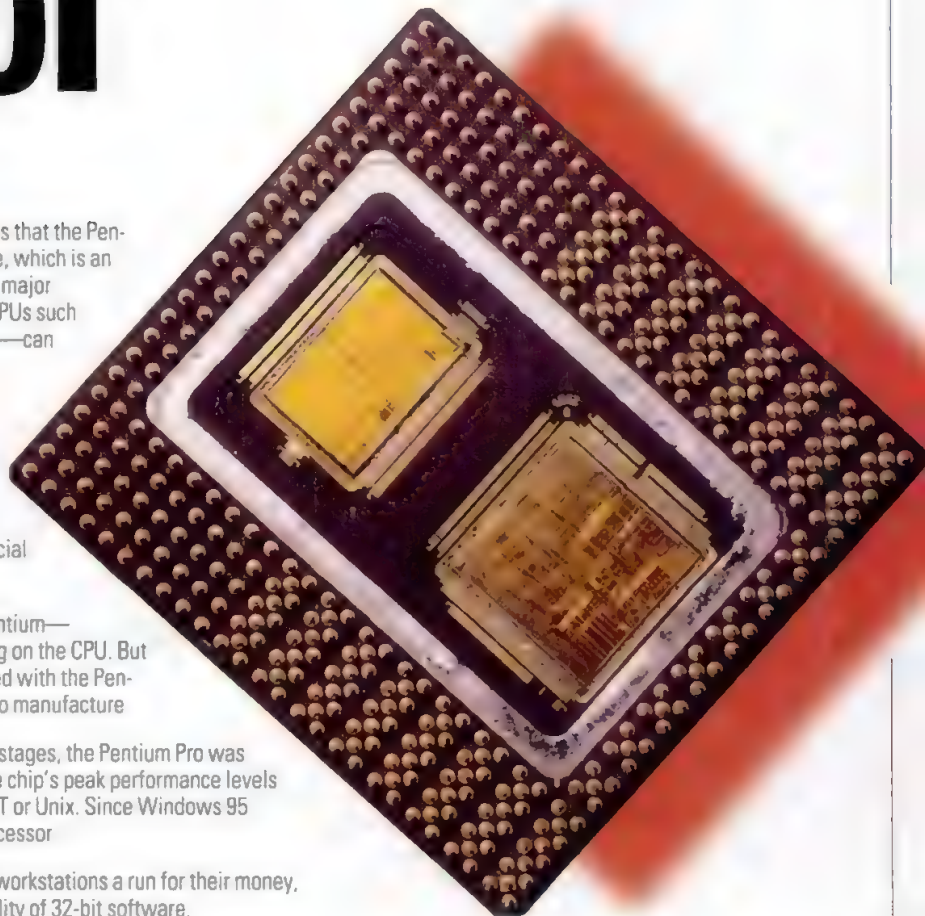
AN AGGRESSIVELY SUPERSCALAR DESIGN means that the Pentium Pro can execute three instructions per clock cycle, which is an improvement over the Pentium. But the Pentium Pro's major competition in the workstation arena—RISC-based CPUs such as Digital's Alpha and Sun Microsystems' Ultra Sparc—can execute four or more instructions per clock cycle.

FLOATING-POINT PERFORMANCE is vastly improved over the Pentium's, but can it compete against RISC-based machines? Although the Pentium Pro still outperforms RISC chips on integer operations, early testing indicates that it lags behind RISC on floating-point-intensive tasks, which are crucial in many mainstream workstation applications.

CPU PRICING WILL BE HIGH compared with the Pentium—about \$1,000 to \$2,000 per chip in quantity, depending on the CPU. But the Pentium Pro has 5.5 million transistors—compared with the Pentium's 3.3 million—making it inherently more costly to manufacture.

FULL 32-BIT OS REQUIRED: From its initial design stages, the Pentium Pro was optimized to run with 32-bit code. This means that the chip's peak performance levels are realized with a full 32-bit OS, such as Windows NT or Unix. Since Windows 95 contains 16-bit code, it is not the ideal OS for this processor.

THE BOTTOM LINE: The Pentium Pro will give RISC workstations a run for their money, but its widespread acceptance hinges on the availability of 32-bit software.



Pentium Pros vs. Pentiums

▲ Higher scores represent better performance.
▼ Lower scores represent better performance.

	Winstone 96 ▲	Disk WinMark 95 ▲	Graphics WinMark 96 ▲	CPUmark ₁₆ ▲	CPUmark ₃₂ ▲
Windows 95					
Dell Dimension XPS Pro150 (Pro/150, 16MB)	64.5	1,030	28.2	262	393
Average P/150 (16MB)	62.0 (-4%)	1,071 (+4%)	21.3 (-19%)	276 (+5%)	273 (-31%)
Average P/166 (16MB)	65.4 (+1%)	1,080 (+5%)	23.6 (-10%)	324 (+24%)	332 (-16%)
	Photoshop Gaussian Blur (seconds) ▼	Photoshop Lighting Effects (seconds) ▼	AutoCAD (min:sec) ▼	C Compiler (min:sec) ▼	CPUmark ₃₂ ▲
Windows NT 3.51					
Gateway P5-166 XL (P/166, 32MB)	70	153	5:17	3:15	N/A
Average Pentium Pro/150 (32MB)	55 (+21%)	80 (+48%)	4:17 (+19%)	2:31 (+23%)	N/A
Gateway P5-166 XL (P/166, 64MB)	34	41	5:05	3:10	324
Average Pentium Pro/150 (64MB)	20 (+41%)	41 (0%)	3:54 (+23%)	2:28 (+23%)	430 (+33%)

Percentages given represent whether the average score is better (+) or worse (-) than the score of the Dell or Gateway reference system.
N/A—Not applicable: We did not run this test with 32MB of RAM.

Pentium chips. They provide a significant boost in performance over the previous speed kings, 120-MHz and 133-MHz Pentiums. On our Winstone 96 tests, the performance improvement is roughly 10 to 20 percent.

While considerable attention has been focused on the prospects for chicken-in-every-pot Internet terminals that might

ing 24MB or 32MB, just to be safe;

- choosing CPUs based on the 66-MHz (not 60-MHz) bus, meaning 166-MHz, 133-MHz, or 100-MHz CPUs. All other things being equal, we find about a 5 percent performance improvement with the faster bus.

RIISING TIDE DROPS CPU PRICES

Whenever Intel introduces a new CPU, the prices of the previously fastest CPUs fall precipitously. Intel says it sells the Pentium/166 for \$749 in 1,000-unit lots and the Pentium/150 for \$547. The Pentium/133 was selling for \$520 (effective through the end of January 1996), down 25 percent from its price last quarter and the Pentium/120's price dropped 39 percent to \$357 over the same period. Many users who want the best combination of price and performance will head for PCs based on the 133-MHz part. Compared to Pentium/166s, you're paying almost twice as much for the CPU for just a 25 percent increase in clock ticks.

PENTIUM PRO: HOW FAST?

PC Labs has tested a handful of Pentium Pro systems before in our First Looks sec-

tion, but this is the first full-fledged showdown. For this roundup of 11 systems, we created and ran a series of workstation-class, application-based, 32-bit performance tests using new 32-bit versions of AutoCAD, Photoshop, and the Symantec C++ Version 7.20 compiler. We also ran 32-bit Word and Excel tests to demonstrate business productivity performance levels. We found Pentium Pro systems ran from no faster to more than 60 percent faster than comparably configured Pentium systems on our 32-bit application tests (see the table "Pentium Pros vs. Pentiums").

Our conclusion: These Pentium Pro systems are formidable workstations. If you want the absolute fastest performance and don't care how much it costs, RISC-based machines are the hot ticket. When cost is an issue, Pentium Pro workstations are the way to go.

And for mainstream users, the newest round of 150-MHz and 166-MHz Pentium Classic systems running Windows 95 and Windows 3.x provide welcome performance boosts, too. We expect you'll see a 180-MHz Pentium CPU later this year and possibly a 200-MHz part.

Service & Reliability Ratings

Service and Reliability ratings are included for vendors that received at least 50 responses in our latest poll of 17,000 subscribers. Their results reflect readers' experience with all desktop PCs from a given vendor. (For details, see our issue of July 1995.) The *reliability* rating is a measure of respondents' satisfaction with the reliability of the vendor's machines in use over the past two years. The *repair* rating is a measure of respondents' satisfaction with the repair service provided by the vendor for machines in use over the past two years. The *tech support* rating is a measure of respondents' satisfaction with the vendor's technical support for machines in use over the past two years. The *percent needing repair* rating is a measure of the proportion of machines that respondents indicated needed repair in the first year of use.

▲ Better than average Average ▼ Worse than average

Vendor	Reliability	Repair	Tech support	% needing repair
Acer	▲	▲	▲	▲
Compaq	▲	▲	▲	▲
Dell	▲	▲	▲	▲
Digital	▲	▲	▲	▲
DTK	▲	▲	▲	▲
Gateway	▲	▲	▲	▲
Hewlett-Packard	▲	▲	▲	▲
IBM	▲	▲	▲	▲
Micron	▲	▲	▲	▲
NEC	▲	▲	▲	▲
USA Flex	▲	▲	▲	▲
ZDS	▼	▼	▼	▼

RECENT REVIEWS

On the Road with the Pentium

January 23, 1996.....page 100
41 Color Pentium notebooks.

PC, Come Home

December 19, 1995.....page 136
32 Windows 95-equipped home systems.

A Pentium for Every Desktop

December 5, 1995.....page 102
103 machines in total: 20 Windows 3.1 machines and 83 Windows 95 PCs.

retail for as low as \$500, among PC users there's greater interest in spending *more* and moving up the performance ladder. Corporate, small office, and home users all believe they squeeze an extra year of life out of a PC if they buy more computer today. That means acquiring:

- faster CPUs and 256K L2 caches;
- 16MB—not 8MB—system memory configurations, with some users consider-

Our Contributors: BILL HOWARD is an executive editor of *PC Magazine*. ROBERT S. ANTHONY is a senior writer for *PC Magazine*. MARY E. BEHR and ANUSH YEGYAZARIAN are staff editors and CHARLES LIN is a freelance writer for *PC Magazine*. BRUCE BROWN is a contributing editor of *PC Magazine*. CAROL VENEZIA was the associate editor in charge of this story, and RICHARD FISCO was the project leader.

PENTIUM PRO WORKSTATIONS

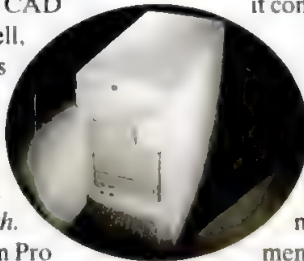
The New Contenders

PC Labs puts 11 of the first 150-MHz Pentium Pro workstations through their paces. **BY CAROL VENEZIA**

Take a good look at your desk. Do you have a PC in one space for your basic business apps like e-mail and word processing, and a workstation in another for your "serious" stuff like CAD and 3-D modeling? Well, that's the space Intel wants to occupy with a system powered by its new Pentium Pro CPU, introduced on November 1, 1995. Which space, you ask? *Both.*

Intel claims that Pentium Pro systems are excellent solutions for high-end applications in many arenas, including visual, scientific, and technical computing; multimedia authoring; and 3-D modeling. Intel says that the Pentium Pro's "high performance and underlying

PC economics will provide a compelling reason for those users to own a single desktop system for both their authoring and personal productivity needs." So does it come through?



WORKSTATION-MARKET DYNAMICS

Up until now, the workstation market has been dominated by RISC-based Unix machines from Digital Equipment Corp., Hewlett-Packard Co., IBM Corp., Silicon Graphics, and Sun Microsystems, among others. But these systems are notoriously proprietary beings: Each system typically runs on its vendor's own flavor of Unix (whereas the Pentium Pro will operate on either Windows NT or

► IN THIS REVIEW

Compaq Computer Corp.	112
Dell Computer Corp.	114
Digital Equipment Corp.	114
DirectWave Inc.	127
Hewlett-Packard Co.	127
IBM PC Co.	130
Micron Electronics Inc.	131
MiTAC	131
NEC Technologies Inc.	131
Sys Technology Inc.	133
Zenith Data Systems	133
Editors' Choice	108
The Next Step: 200-MHz Pentium Pro	110
Price/Performance Index:	
Pentium Pro Workstations	112
Performance Tests	116
Summary of Features	127

Unix). Many of the applications that run on them are custom-built, and the bottom line is that they're just plain expensive. Could the Pentium Pro be just what the workstation market needs?

INSIDE THE CHIP

To play in the workstation space, the Pentium Pro couldn't just be faster, it also had to improve its floating-point capabilities.

Unlike the Pentium, the Pentium Pro employs an assertively superscalar design, able to process up to three instructions per clock cycle, as compared with the Pentium's two. Digital's Alpha 21164A and Sun's UltraSparc, by comparison, can process four instructions per clock cycle. But perhaps more important, the Pentium

HIGHLIGHTS

Pentium Pro Workstations

The Pentium Pro processor is geared to take on the workstation market traditionally dominated by Unix-based machines from such companies as Digital Equipment Corp., Hewlett-Packard Co., NEC, Silicon Graphics, and Sun Microsystems. Unlike the Pentium chip, the Pentium Pro has the floating-point muscle to handle the CAD and 3-D rendering operations these machines are called upon to execute.

Superpipelining allows the Pentium Pro to achieve higher clock speeds than ever before. Superscalability means the Pentium Pro is ideally capable of processing three instructions per clock cycle. Unlike the Pentium, it can take instructions out of order,

processing the "easiest" ones first. While this can speed up the processing of 32-bit code, it can be detrimental when dealing with 16-bit code.

To get the most out of your investment, we recommend that you pair your Pentium Pro unit with a true 32-bit operating system like Windows NT or OS/2. This processor was optimized to run 32-bit code, and it therefore performs at its best with 32-bit applications (although you won't realize a big performance boost with 32-bit business applications such as spreadsheets or word processors).

Don't skimp on memory: 32MB of RAM and at least 1GB of disk storage is a bare-minimum con-

figuration for a workstation of this class—and the applications you'll really want to run will demand every bit of it and more. Also consider the amount of memory you'll need for your graphics accelerator card before you make a purchase. For many applications, a DRAM-based card (which is adequate for a Pentium PC) doesn't provide enough bandwidth for graphics-intensive applications.

Windows NT is directly supported by all vendors represented in this roundup, but OS/2 is not. In fact, only two vendors here—DirectWave and IBM—sell systems preconfigured with OS/2 and all of its necessary hardware drivers.

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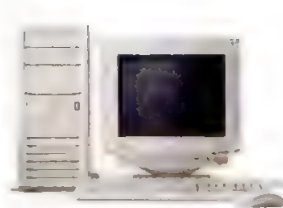
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	575e	5120e	5100	5133
Processor	Pentium 75MHz	Pentium 120MHz	Pentium 100MHz	Pentium 133MHz
Std./Max. Memory	8MB/136MB	8MB/136MB	16MB/192MB	16MB/192MB
Hard Drive	630MB or 1GB	630MB or 1GB	630MB or 1GB	1GB
Cache Internal	16KB	16KB	16KB	16KB
Cache External	256KB (optional)	256KB (optional)	256KB	256KB
Architecture	PCI	PCI	TriFlex/PCI	TriFlex/PCI
Video Memory/Max.	1MB/2MB	1MB/2MB	1MB/2MB	1MB/2MB
Compaq 150 Color Monitor	Yes	Yes	Yes	Yes
Diskette Drive	3.5" 1.44MB	3.5" 1.44MB	3.5" 1.44MB	3.5" 1.44MB
Expansion Slots (Total)	3	3	4	5
Drive Bays (Total)	3	3	4	5
Ports: Serial/Parallel	1/1 (ECP)	1/1 (ECP)	1/1 (ECP)	1/1 (ECP)
Security Features	Yes	Yes	Yes	Yes
Processor Upgradable	Yes	Yes	Yes	Yes
101-Key Keyboard, Mouse	Yes	Yes	Yes	Yes
Software Preinstalled (Choice of)	MS-Windows* 95 or MS-Windows 3.1	MS-Windows 95 or MS-Windows 3.1	MS-Windows 95 or MS-Windows 3.1	MS-Windows 95 or MS-Windows 3.1
Energy Star Compliant	Yes	Yes	Yes	Yes
Limited Warranty*	3-Year	3-Year	3-Year	3-Year
Price†				
630MB Hard Drive	\$1,779	\$2,269	\$2,279	-
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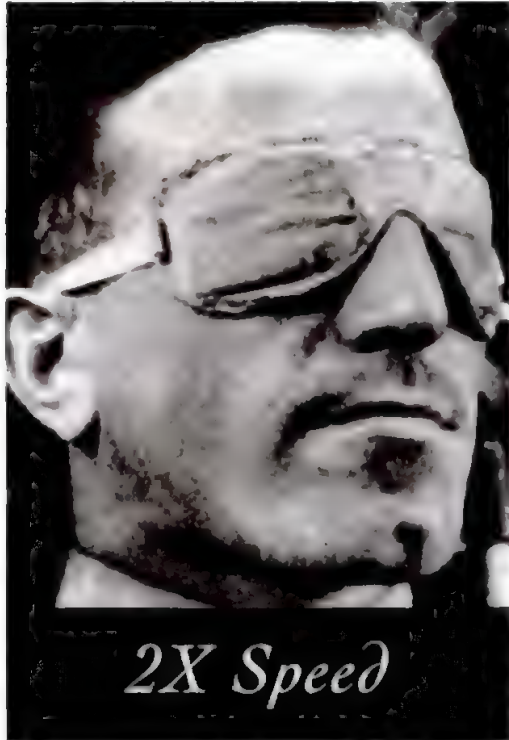
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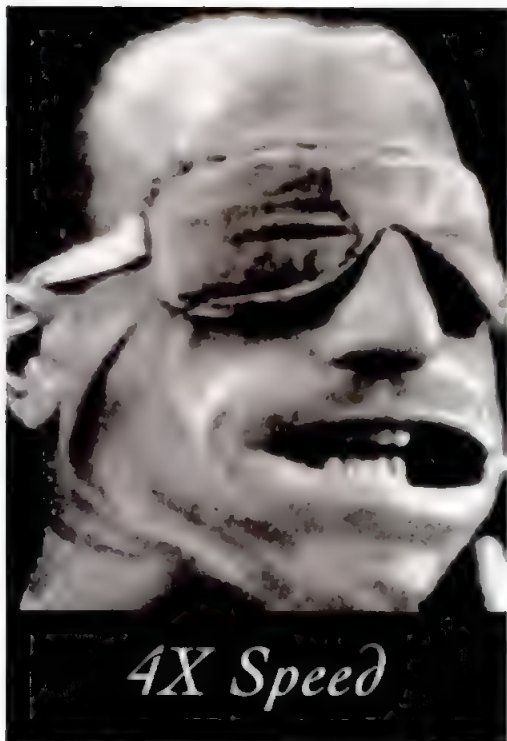
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SEE, HEAR
AND FEEL THE
DIFFERENCE:

NEC

Pro is superpipelined; that is, its pipelines are deeper than the Pentium's, allowing it to reach higher clock speeds.

To squeeze the most out of its superpipelined design, the Pentium Pro uses an out-of-order execution engine. Unlike the Pentium, the Pentium Pro can reorder instructions: It processes those that are ready for execution and sets aside those that cannot be processed right away for completion at a later time. This method ultimately speeds up the processing of 32-bit code, which is what the chip is built for.

The Pentium Pro's floating-point capabilities are also significantly beefier than the Pentium's (although still not as robust as many RISC designs). Unlike the Pentium's floating-point unit (FPU), the Pentium Pro's FPU is fully pipelined, which speeds performance, especially when it's executing multiple floating-point operations in succession. And floating-point operations themselves simply take longer to execute than integer operations. The Pentium Pro's dynamic execution features effectively make up for these floating-point latencies, because the chip can conduct other operations while the FPU is busy.

The Pentium Pro also attacks the Pentium's biggest problem with floating-point operations: the x86 architecture's reliance on a stack-based model. The x86's use of a stack-based model forces programs to execute floating-point exchanges (FXCHs) frequently in order to access information that resides elsewhere in the stack. The Pentium Pro features dedicated FXCH hardware that permits access to any stacked item without incurring latencies.

BITS OF DIFFERENCE

When the Pentium Pro's design process began in 1991, Intel thought that the software world would have shifted to predominantly 32-bit operating systems and applications by the time of the chip's introduction. Surprise! Even though the industry is slowly going 32-bit, most of the world still uses 16-bit applications, and even Windows 95 is not a completely 32-bit OS.

This is where the Pentium Pro's superpipelined design comes into play. Yes, it works great with 32-bit code. But it doesn't handle 16-bit code as effectively, because certain instructions within 16-bit

HP Vectra XU 6/150

Though competition was fierce among the 11 systems in this Pentium Pro roundup, one machine clearly pulled ahead of the pack: The HP Vectra XU 6/150 (street price: \$8,600 with 64MB of RAM). A strong

performer across all our tests, it boasts a unique design that meets today's requirements while keeping an eye on the future.

This machine's motherboard, designed and manufactured by HP, features dual-processor support, making the Vectra XU the only machine in this roundup capable of symmetric multiprocessing. Use of dual in-line memory modules (DIMMs) instead of single (SIMMs) enables the Vectra XU to support a 128-bit memory path—twice as wide as that of other tested workstations. But HP doesn't stop there: It has equipped the Vectra XU with ECC memory modules, which can detect dual-bit errors as well as detect and correct single-bit errors to help protect data integrity. A 2GB Fast SCSI-2 hard disk, a

10/100 PCI Ethernet card, a Matrox MGA Millennium graphics board with 2MB of WRAM, a 17-inch monitor, and a three-year parts-and-labor warranty with one year of on-site service round out the package.

An honorable mention goes to Micron's Pro 150 Magnum Plus (street priced at \$8,497 with 64MB of RAM). Its price covers a 21-inch Hitachi Accuvue XU monitor as well as a Number Nine Imagine 128 Pro graphics card with a whopping 8MB of VRAM. Micron also included a 2GB SCSI-3 hard disk, Creative Labs Sound Blaster AWE32 Value Edition, and a 6X CD-ROM drive. These components all contributed to the Pro 150 Magnum Plus's solid performance on most of our application tests.



code cannot be executed out of order. Other operations stop in order for the Pentium Pro to complete one of these instructions; depending on the operation, other instructions pending completion may need to be flushed and reloaded, further slowing down processing.

PENTIUM PRO • WIN 95? NOT!

Our testing proves that the Pentium Pro is not the processor of choice if you're running 16-bit applications (see the table "Pentium Pros vs. Pentiums"). We loaded Windows 95 onto a Dell Dimension XPS Pro150, outfitted with a 150-MHz Pentium Pro processor and 16MB of RAM. We then ran our standard benchmark tests and found that this machine produced a score on our Winstone 96 test that was only 4 percent higher than the average of the 150-MHz Pentium PCs we tested for this issue (in the article "The Powers That Be"). And although this Dell machine did produce a Graphics WinMark score 19 per-

cent faster than that of the average Pentium/150, its Disk WinMark 96 score was actually 4 percent lower.

CHIP ECONOMICS

Simple economics also dictate that a Pentium Pro system should be equipped with the appropriate OS and software in order to exploit the chip's potential fully. To be blunt, the Pentium Pro ain't cheap: In its initial implementation at 150 MHz (a 133-MHz part was scrapped) with 256K of on-board L2 cache (the Pentium Pro uses a dual-cavity design, so the cache chip actually sits next to the CPU chip inside the PGA package), this chip costs \$974 per part in 1,000-unit quantities. By comparison, 150-MHz Pentiums cost \$547 per chip and Pentium/166s cost \$749 per chip.

The Pentium Pro's price is higher because of the chip's complexity. The processor contains 5.5 million transistors, a little less than double the number found in the Pentium. Add 15.5 million more

**Has lived in New York all his life.
Never visited the Empire State Building.**



transistors for the on-board L2 cache and you have a part that is inherently expensive to manufacture.

How does this translate into system prices? The average Pentium Pro unit here costs about \$7,800, while the average price of the Pentium/166 PCs we tested for our companion story is about \$3,750. Keep in mind, though, that we required 64MB of RAM for the Pentium Pros and only 16MB for the Pentiums. The additional RAM alone would add about \$2,000 (assuming \$40 per megabyte) to the price of a Pentium/166. With an added \$250 for Windows NT, the price would be about \$6,000.

We consider 32MB of RAM the bare minimum for Pentium Pro workstations, so don't be fooled into thinking that memory is a good place to shave a few hundred dollars off system costs.

REVIEW CRITERIA

For this roundup, we required Pentium Pro workstations preloaded with Windows NT 3.51 and 64MB of RAM installed. Because we also ran performance tests with 32MB of memory, we required that each machine's RAM be easily downgradable. We also required 1GB

hard disks or larger, formatted using NT File System (NTFS); a minimum of 2MB of memory on each system's graphics card; quad-speed CD-ROM drives or faster; and at least 15-inch monitors.

We ran these Pentium Pro workstations under Windows NT 3.51, using both performance measures developed by PC Labs, and our CPUmark₁₆ and CPUmark₃₂ benchmark tests. The performance measures—which encompass Adobe Photoshop Version 3.0.4, AutoCAD (R13c3), Microsoft Excel, Microsoft Word, and a C Compiler test using Version 7.20 of Symantec's C++ development environment—were designed to exercise typical 32-bit workstation-centric operations.

Because these are literally the first Pentium Pro workstations off the assembly lines, we received only systems with 150-MHz CPUs for review. But 200-MHz machines are right around the corner; we received early uniprocessor models from Gateway 2000 and Micron, and dual-CPU machines from ALR and HP (see the sidebar below). You can also expect to see many systems utilizing Intel-made motherboards, for time-to-market and system-cost reasons.

We caught a few vendors in the early stages of production, and others were simply unable to get their hands on the processor itself, which will initially be in very short supply. Expect to see Pentium Pro machines from Acer America Corp., AST Research, Polywell Computer, and Tangent Computer—among many others—in the near future.

WHAT WE FOUND

Perhaps the most exciting machine in this roundup is our Editors' Choice, the HP Vectra XU 6/150 from Hewlett-Packard Co. This workstation plants a stake in the technological high ground and will likely set the standard for all other vendors in the Pentium Pro market to follow.

The Vectra XU—based on an HP-designed and -manufactured motherboard—uses DIMMs (dual in-line memory modules) instead of the SIMMs used by other vendors. DIMMs allow for a 128-bit memory path by interleaving memory on alternating memory-access cycles. Standard SIMMs provide only a 64-bit data path in most designs. The Vectra XU's DIMMs are ECC (error-correction code) DIMMs, which are able to detect and correct single-bit errors.

The Next Step: 200-MHz Pentium Pro

By Bruce Brown

Our tests showed that a 200-MHz Pentium Pro system is faster than a comparably configured 150-MHz machine on all applications. Two processors are better only for multitasking or for multithreaded applications.

We tested the \$9,109 ALR Evolution Dual6, the \$6,564 Gateway 2000 G6-200, the \$11,326 (street price) HP Vectra XU 6/200, and the \$8,897 Micron Pro 200 Magnum Plus with the same application and benchmark tests we used for the 150-MHz Pentium Pro PCs. The ALR and HP systems each had a dual-CPU motherboard with two 200-MHz Pentium Pro processors; we tested them with a single CPU active and with both CPUs active.

On the average, the four single-CPU 200-MHz systems were 17 percent to 33 percent faster on our tests than the

Pentium Pro 150 systems. On many single-threaded application tests, the scores posted with two CPUs active were close to or a bit slower than those garnered with a single active CPU—the slight degradation being due to proces-

sor overhead. Nonmultithreaded functions, like the Photoshop Lighting Effects test, ran a little slower with two CPUs, while multithreaded functions, like the Photoshop Gaussian Blur, showed an improvement of 35 percent.

Pentium Pro/200 Systems

	▼ Lower scores represent better performance.	▲ Higher scores represent better performance.	▼	▼	▼	▼	▲
	Photoshop Lighting Effects (seconds)	Photoshop Gaussian Blur (seconds)	AutoCAD (min:sec)	C Compiler (min:sec)	CPUmark ₃₂		
ALR Evolution Dual6 (one Pentium Pro/200)*	29	15	3:08	2:03	561		
ALR Evolution Dual6 (two Pentium Pro/200s)*	30	10	3:08	2:03	561		
Gateway 2000 G6-200 (one Pentium Pro/200)*	29	15	2:57	1:59	551		
HP Vectra XU 6/200 (one Pentium Pro/200)*	29	15	2:49	1:54	568		
HP Vectra XU 6/200 (two Pentium Pro/200s)*	30	10	2:50	1:53	568		
Micron Pro 200 Magnum Plus (one Pentium Pro/200)*	29	15	2:55	1:53	573		
Average Pentium Pro/150 (reviewed in this issue)	41	20	3:54	2:26	430		

* Reviewed in First Looks, February 8, 1996.

We ran all tests with 64MB of RAM.

**Was born and raised in Paris.
Has never been to the top of the Eiffel Tower.**



Price/Performance Index: Pentium Pro Workstations

The HP Vectra XU 6/150, our Editors' Choice, is the second most expensive machine in this field but well worth the price (\$8,600 street, with 64MB of RAM). It offers ECC memory using DIMMs, which support a 128-bit memory path—twice as wide as usual. It's also the only dual-processor-capable machine in this roundup, and its performance was consistently top-notch.

Micron's Pro 150 Magnum Plus (\$8,497 street with 64MB of RAM) offers maximum graphics muscle for the money. Components include a 21-inch Hitachi monitor and the speedy Number Nine Imagine 128 Pro graphics card with 8MB of VRAM.

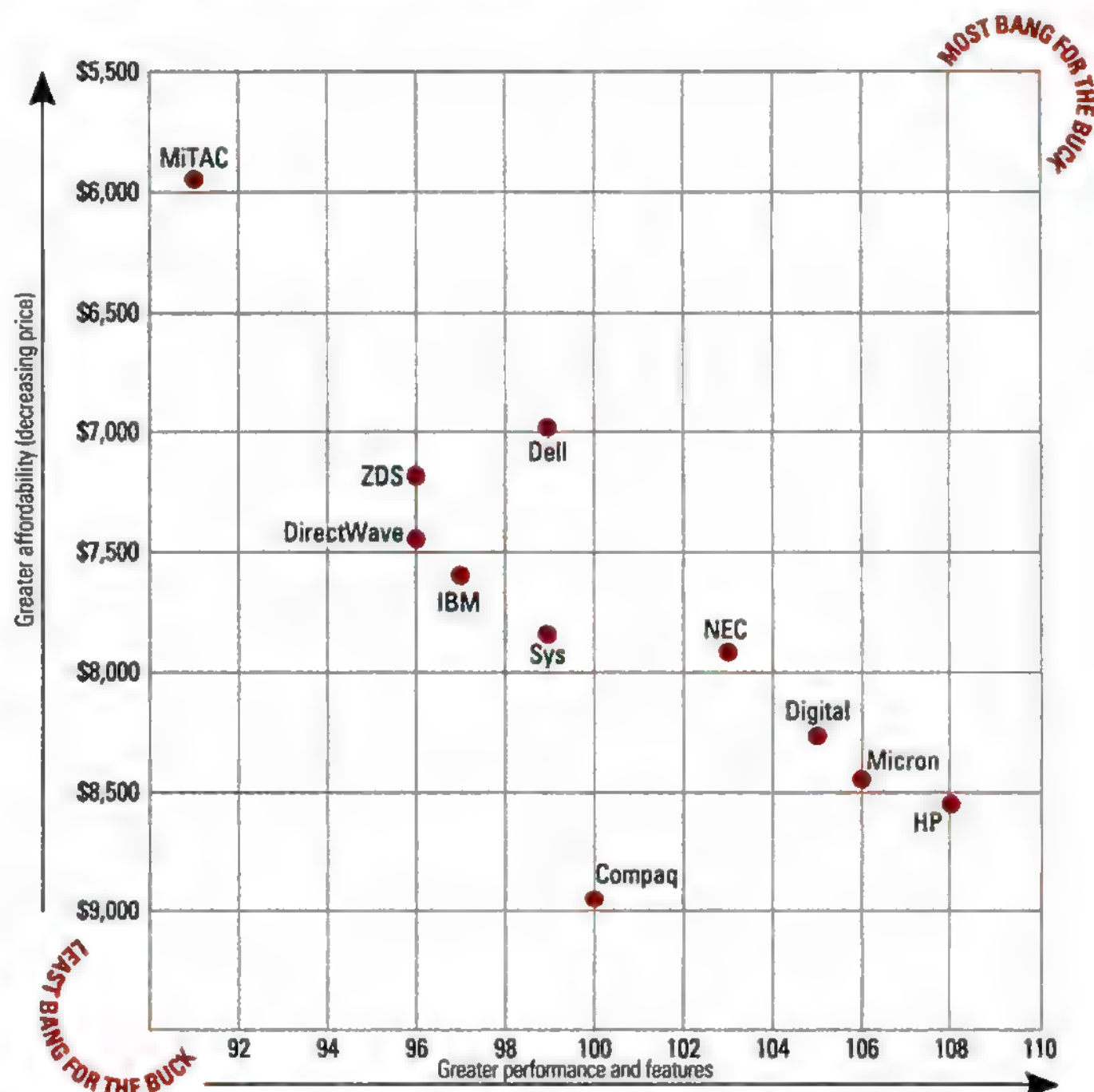
The Dell Dimension XPS Pro150 stands out as a solid value choice. Street priced at only \$7,029 with 64MB of RAM, the Dimension offers competitive performance and a compelling features set that includes a 2GB hard disk, a 17-inch monitor, and a 6X CD-ROM drive.—*Analysis written by Mary E. Behr*

DATA POINTS

Application tests run with 64MB and 32MB of RAM make up 48 percent and those that run at 32MB account for 19 percent of the performance/features score. Elements such as graphics mem-

ory type and size, and the presence of network cards make up about 38 percent of the score. Warranty and service offerings account for the remaining 14 percent. Price/performance index data

can be found in the Hardware Library of the Editorial Forum on PC MagNet under 04P6BANG.TXT and on the World Wide Web at <http://www.ziff.com/~pcmag/pclabs/pclabs.htm>.



For graphics-intensive tasks, we were impressed with Micron Electronics' Pro 150 Magnum Plus. It uses a Number Nine Imagine 128 Pro graphics card with 8MB of VRAM—a capacity virtually unheard of in the mainstream PC market. It also comes with a gorgeous 21-inch Hitachi monitor.

Does an 8MB graphics card sound excessive? Not at this end of the computing spectrum. It's not uncommon to find 3-D and CAD Unix workstations with 24MB of memory or more on their graphics cards. We recently tested a Sun Ultra 1 workstation from Sun Microsystems (First Looks, December 19, 1995, page 42). Based on an UltraSparc CPU, this workstation used a 2-D/3-D frame-buffered graphics card with 15MB of 3DRAM. But the Ultra 1 also costs nearly \$30,000.

STORAGE: THE BIGGER THE BETTER

If you've ever used desktop publishing or image editing packages, you know that the files you create can be huge—possibly tens of megabytes or more. Simply put, workstations of this class can demand an incredible amount of storage space. One system we tested stood out in this area: the Sys Performance Pro150 from Sys Technology. This machine came equipped with two 4.1GB Fast/Wide SCSI-2 hard disks, for a total storage capacity of 8.2GB.

FURTHER EDUCATION NEEDED?

On the whole, this roundup's Pentium Pro workstations are an exciting bunch of systems from a hardware point of view. But we did see a few components that elicited double takes, including DRAM-

based graphics cards and 1GB hard disks, which are smallish for this class of machine. System vendors may have to adjust their PC market-centric mindset in order to compete effectively in an already crowded workstation market.

Compaq Computer Corp.

DeskPro XL 6150

ALL REVIEWS BY BRUCE BROWN

Compaq Computer Corp. aims its Pentium Pro PC, the DeskPro XL 6150, at corporate power users. While its \$8,999 street price (with 64MB of RAM; \$7,199 with 32MB) is a bit higher than the competition's and its tested performance is average for this very fast computer class, corporations looking for

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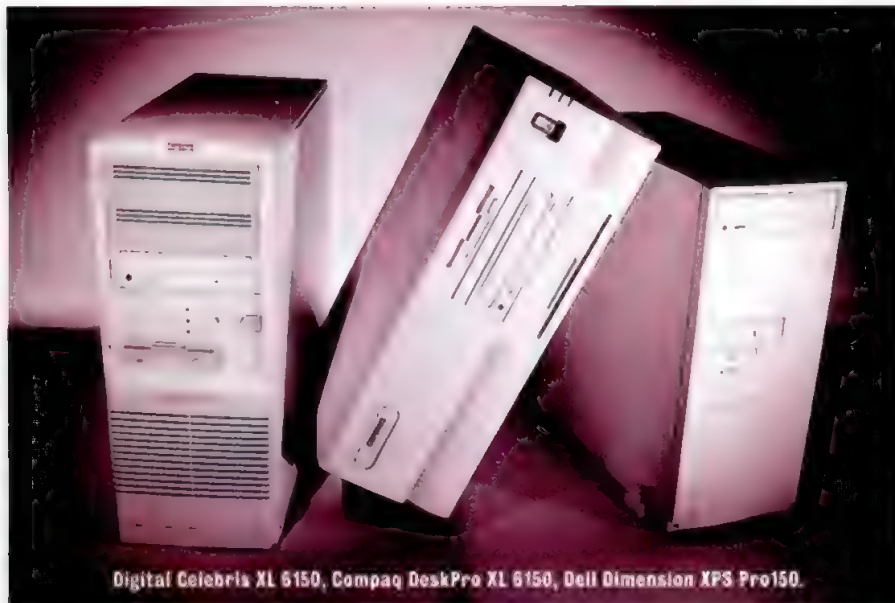
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Microsoft

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Digital Celebris XL 6150, Compaq DeskPro XL 6150, Dell Dimension XPS Pro150.

a top name brand with a good service and support record can purchase the DeskPro XL 6150 with confidence.

This desktop machine (which can be flipped and used as a mini-tower) was the only tested system with an EISA/PCI bus (using Compaq's own motherboard). The DeskPro XL 6150 as configured for testing came with a 1GB Fast SCSI-2 hard disk, a Matrox MGA Millennium graphics card with 4MB of VRAM, a quad-speed CD-ROM drive, and a 17-inch monitor. The system also has FM audio and a 10-Mbps Ethernet interface integrated on the motherboard. The included Compaq Vocalyst keyboard has an integrated speaker with volume control, a microphone, and headphone and microphone jacks.

During performance testing, the DeskPro XL 6150 was an average performer. Most scores were midrange for the class, except for mixed results on Photoshop tests, depending on memory.

Compaq Computer Corp. provides a three-year parts-and-labor warranty with one year of on-site service and 24-hour, 7-day technical support. That, along with the company's top rating in *PC Magazine's* Service and Reliability survey, should instill confidence in prospective buyers.

DeskPro XL 6150. Street price: \$8,999. Compaq Computer Corp., Houston, TX; 800-345-1518; fax, 713-518-1442; <http://www.compaq.com>. Circle 445 on reader service card.

Dell Computer Corp.

Dimension XPS Pro150

Dell Computer Corp.'s Dimension XPS Pro150 is a great deal. Aggressively priced on the street at \$7,029 with 64MB of RAM (\$5,999 with 32MB of RAM), the XPS Pro150 was a good performer on most tests. And it is well stocked with components, including a 17-inch monitor and Altec Lansing ACS-31 speakers with subwoofer. This system is backed by a good service and support package, and it's a solid choice for its target market of power users and early adopters.

Our mini-tower test system utilized an Intel motherboard and was configured with a 2GB Fast ATA-2 hard disk and a Number Nine Imagine 128 graphics card with 4MB of VRAM. A 6X CD-ROM drive provides fast data throughput and is a good base for Dell's multimedia components, which, in addition to speakers, include a Creative Labs AWE32 audio card with FM and wavetable support. For general applications, Microsoft Office Professional 95 was also installed.

The XPS Pro150 attained average scores on most of our performance tests. The unit did turn in above-average scores on the Excel tests.

Dell provides a three-

year-parts, one-year-labor warranty, with on-site service for the first year and 24-hour, 7-day, toll-free technical support. **Dimension XPS Pro150.** Street price: \$7,029. Dell Computer Corp., Austin, TX; 800-289-3355, 512-338-4400; fax, 800-727-8320; <http://www.dell.com>. Circle 446 on reader service card.

Digital Equipment Corp.

Celebris XL 6150

Digital Equipment Corp.'s Celebris XL 6150 is targeted as a price/performance workstation for mission-critical technical users. This machine's price—\$8,316 (street) with 64MB of RAM; \$6,847 with 32MB—is a bit high given its components, but reasonable performance and a well-deserved worldwide reputation for service and support make it a likely candidate for those buyers looking for the reassurance of a familiar name in corporate computing.

Digital's own motherboard—which can be upgraded via Digital's PowerGrade 266 daughterboard with an Alpha 21064 processor—is installed in a mini-tower case. The Celebris XL 6150 included a 1GB SCSI-2 hard disk, a Matrox MGA Millennium graphics card with 2MB of VRAM, and a 15-inch monitor. The system also has a serial infrared interface, a quad-speed CD-ROM drive, and an Ensoniq Soundscape wavetable audio card (a \$219 option that is not included in the price above).



IBM PC 330 with Pentium Pro Processor, DirectWave Blue Thunder P0150, HP Vectra XV 6/150.

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about sex was
difficult, wait until
they ask you
about computers.



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This roundup of the first Pentium Pro workstations introduced us to features that we don't normally see in mainstream Pentium PCs, such as 8MB graphics cards and ECC memory. And our CPUmark₃₂ tests proved that the Pentium Pro performs best in 32-bit environments.

What the Numbers Mean

WORD AND EXCEL MACRO TESTS

Both of our test scripts for Microsoft Word and Microsoft Excel are macro-driven, and each performs a number of common operations using typical data files. We ran these tests on systems equipped with both 32MB and 64MB of memory. Because Word and Excel do not stress the memory subsystem beyond 32MB of RAM, the systems posted nearly identical scores across the two memory configurations tested.

Combining a unique 128-bit wide memory bus, a fast-spinning SCSI-2 hard disk, and a Matrox MGA Millennium graphics card, the HP Vectra XU 6/150 was able to turn in the best times on both tests. The DirectWave Blue Thunder PO150 was unable to install either application and therefore received a Not Applicable rating on these tests. DirectWave said that it is updating the unit's drivers to solve this problem.

AUTOCAD TEST

Our AutoCAD test exercises a broad range of system capabilities, including the CPU's integer and floating-point ability, as well as the capabilities of each machine's disk and video subsystems. The amount of memory installed did have a slightly greater effect on performance on these tests. With 64MB of RAM installed, systems were able to perform almost 10 percent faster than they managed with 32MB of memory. The Micron Pro 150 Magnum Plus and the HP Vectra XU 6/150 turned in the fastest times at 32MB, while the DirectWave Blue Thunder PO150 edged them out with 64MB of memory.

C COMPILER TEST

The World Wide Web Consortium (W3C) Reference Library Benchmark consists of a set of C source code modules, largely platform-independent, which may be used to build World Wide Web servers, clients, and proxies. The programs were compiled into a 32-bit DLL library with Version 7.20 of Symantec's C++ development environment. On the C Compiler test, these Pentium Pro machines showed little performance variance with different amounts of memory installed. On the whole, they posted times about 3.5 percent faster with 64MB of memory than with 32MB. The HP Vectra XU 6/150 was again able to turn in the best

time with 32MB, while the Blue Thunder PO150 topped the charts with 64MB of memory.

PHOTOSHOP TESTS

The Adobe Photoshop Lighting Effects filter allows applications of up to 16 different light sources on an image. Three different types of lights and five lighting styles are possible. The Lighting Effects test stresses floating-point processing capability and is applied to an 18.5MB TIFF image.

Memory was a big factor on these tests. Tests run with 64MB of RAM were completed almost twice as quickly as those run with 32MB. The HP Vectra XU 6/150 was the overall performance leader, garnering a first-place score with 32MB and tying for first place with 64MB of memory with IBM PC Co.'s PC 330 with Pentium Pro Processor and Zenith Data Systems' Z-Station GT Pentium Pro.

The Gaussian Blur filter blurs a selection by an adjustable amount. This filter adds low-frequency detail and can produce a hazy effect. We applied a blur of radius 25. The Photoshop Gaussian Blur test, which operates on a 15MB TIFF image, stresses the CPU/memory subsystem and performs integer calculations. For this test the amount of memory installed was a major factor: Across the board, machines performed more than twice as fast with 64MB of memory as they did with 32MB. The DirectWave Blue Thunder PO150 posted the best time with 32MB, and seven systems tied for first place with 64MB of memory.

CPUMARK₁₆ AND CPUMARK₃₂ TESTS

The CPUmark₁₆ and CPUmark₃₂ scores indicate the speed of a computer's processor subsystem under 16-bit and 32-bit Windows operating systems. WinBench 96 bases these scores on large instruction mixes that emulate the CPU activity of real-world applications. We ran the CPUmark₁₆ and CPUmark₃₂ tests at the 64MB memory setting. The results of these tests show the Pentium Pro's lackluster CPU performance with 16-bit processes, and its true speed with 32-bit processes.

Pentium Pro/150 machines averaged 271 on the CPUmark₁₆ tests and 430 on the CPUmark₃₂ measure. When we compare these scores with the averages posted by the Pentium/150 and Pentium/166 machines tested for our companion story, we get some interesting findings. While the Pentium/150 average was virtually identical to the Pentium Pro average on the CPUmark₁₆ tests, the Pentium/166 average of 310 was actually higher. On the CPUmark₃₂ tests, however, the average Pentium Pro machine soundly trounced units with both speeds of Pentium.

How We Tested

We tested all of the Pentium Pro workstations in this review with Windows NT Workstation, Version 3.51, and 1GB hard disks or larger. All hard disks were formatted using Windows NT File System (NTFS). We ran all of our tests with both 32MB and 64MB of RAM installed (except for the CPUmark

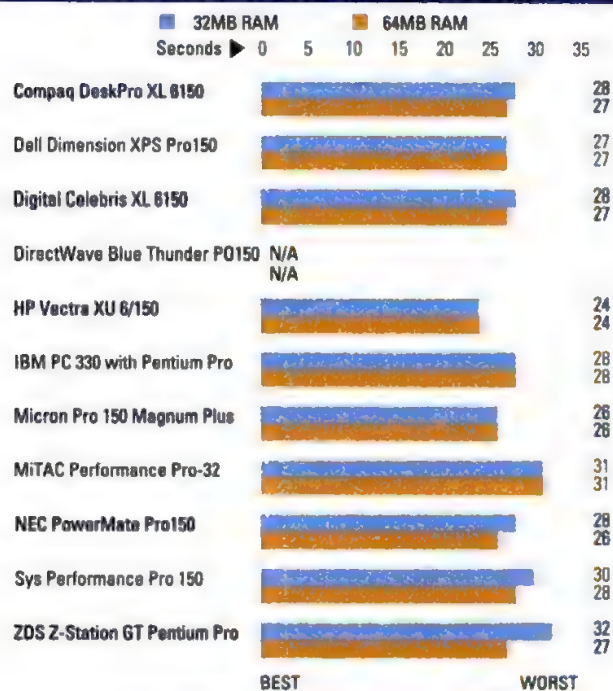
tests, which we ran only with 64MB of RAM). We used each vendor's preinstalled graphics driver for 800-by-600 resolution with 16.7 million colors (True Color).

MICROSOFT WORD AND MICROSOFT EXCEL MACRO SCRIPTS

Both of our test scripts for the **Microsoft Word Macro Script** tests and the **Microsoft Excel Macro Script** tests are macro-driven and perform a

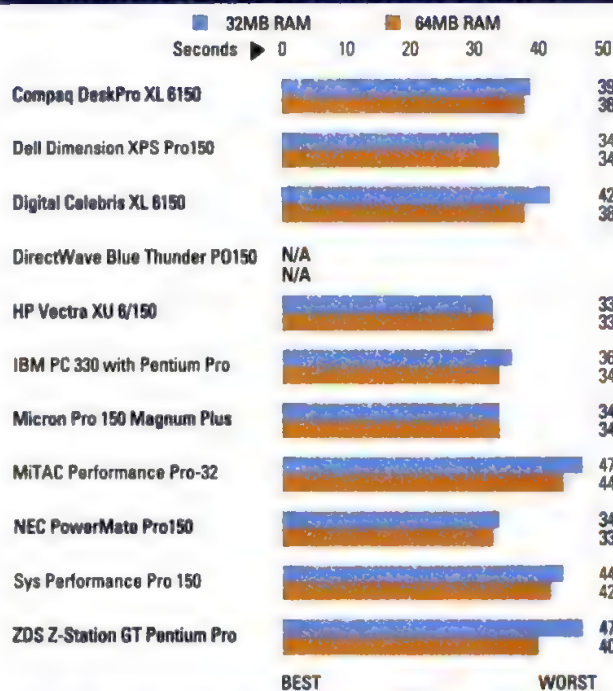
number of common operations using typical data files. The tests are modeled after functions performed in our Winstone 96 Word and Excel test suites. Functions such as spell-checking, font changes, copies and deletes, repaginations, and print previews are performed in the Word script, and operations such as recalculations, statistical functions, cuts and pastes, and charting are performed in the Excel script. We use Microsoft Office 95, Version 7.0, for these tests.

MICROSOFT WORD MACRO SCRIPT



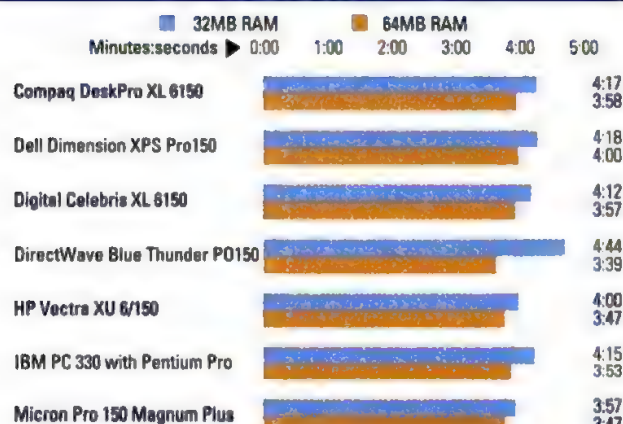
N/A—Not applicable: Microsoft Office 95 could not be loaded on this unit.

MICROSOFT EXCEL MACRO SCRIPT

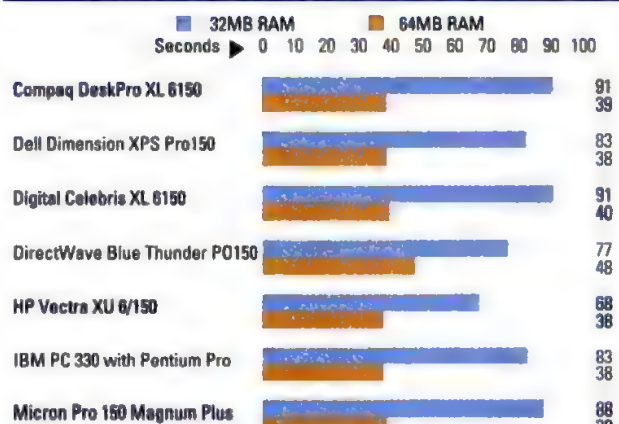


N/A—Not applicable: Microsoft Office 95 could not be loaded on this unit.

AUTOCAD



PHOTOSHOP LIGHTING EFFECTS



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So what can you do with all these extraordinary accomplishments? You can start bringing your office with you. You can start running faster than your competitors. You can start running longer than your competitors. You can start making the future work for you today. In other words, you can start doing extraordinary things. And it starts with a call. Better yet, make that a speed dial. 1-800-TI-TEXAS. E-mail: 2ti@msg.ti.com
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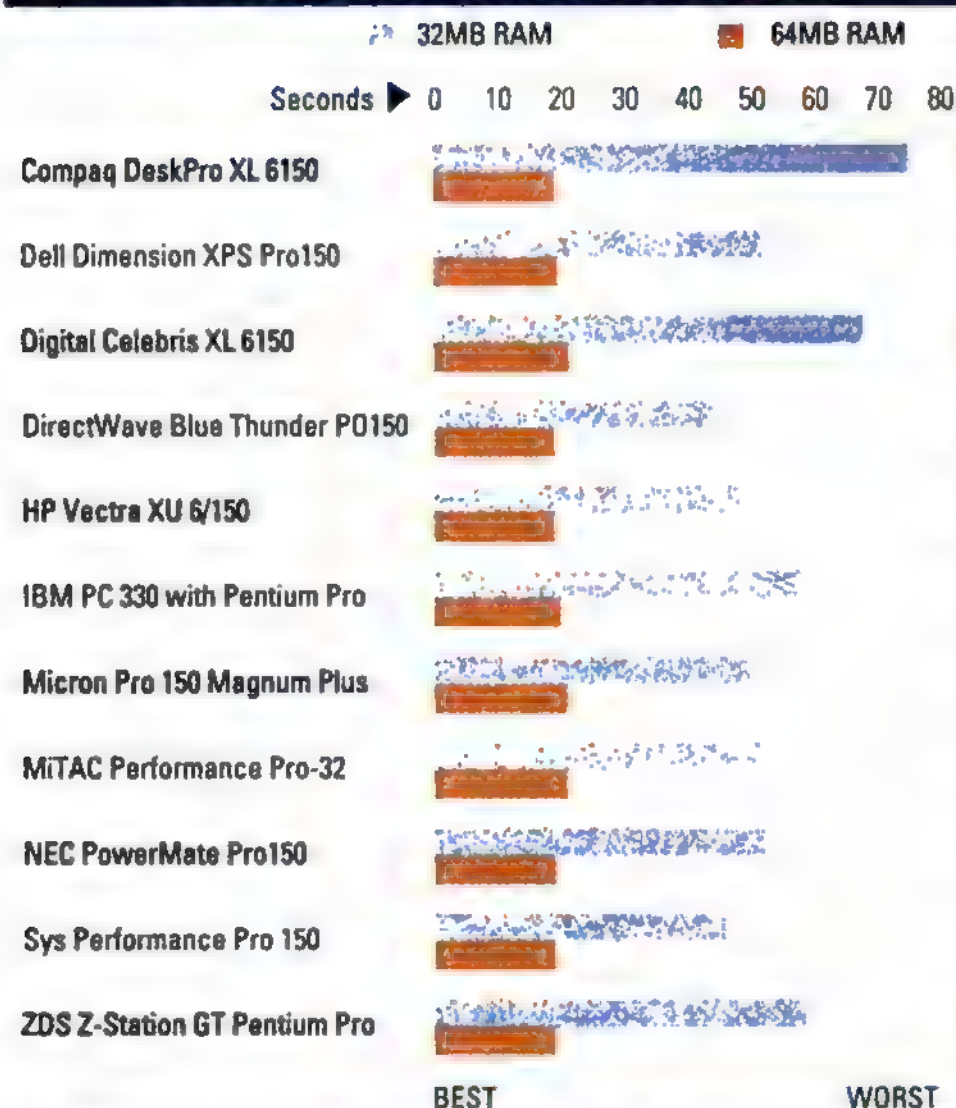


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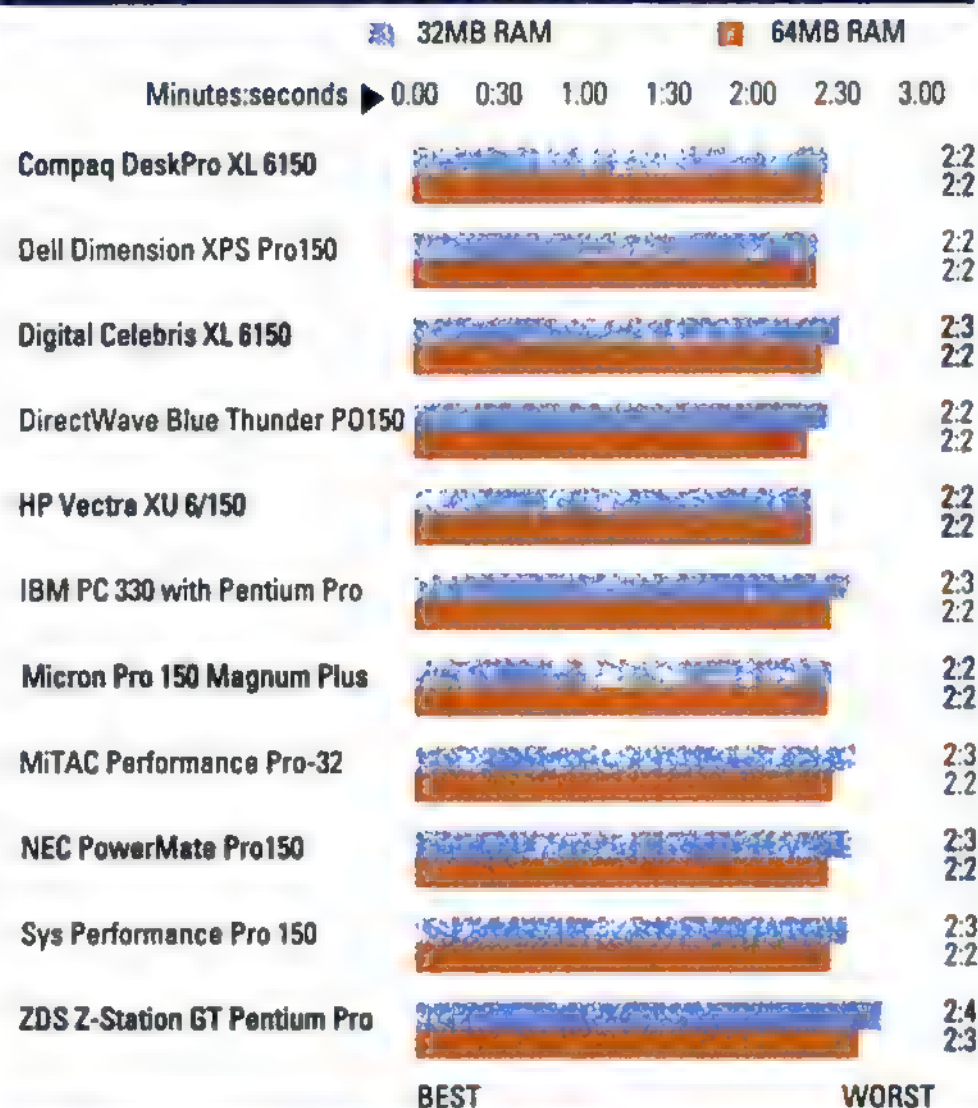
**TEXAS
INSTRUMENTS**

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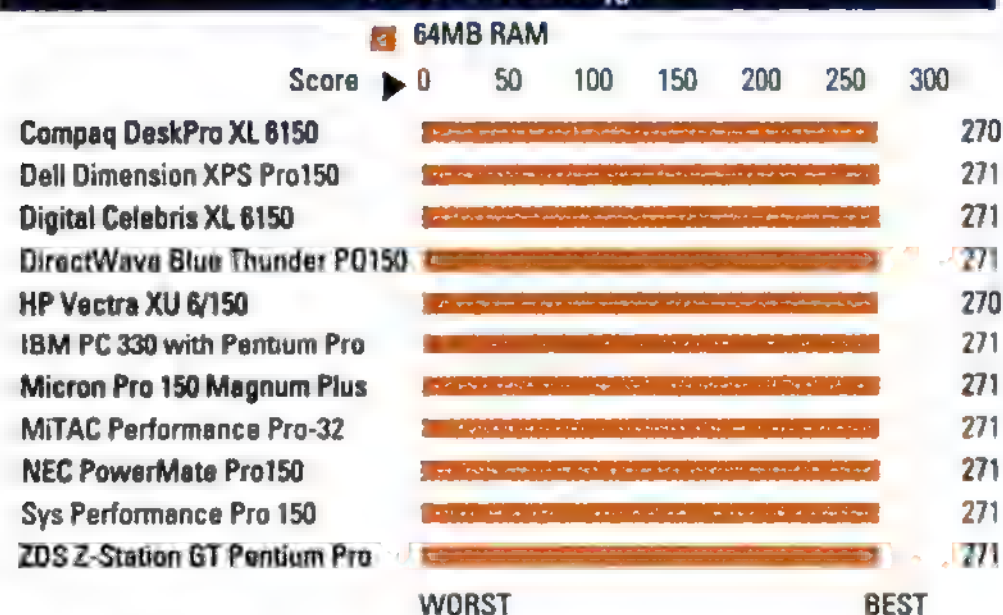
PHOTOSHOP GAUSSIAN BLUR



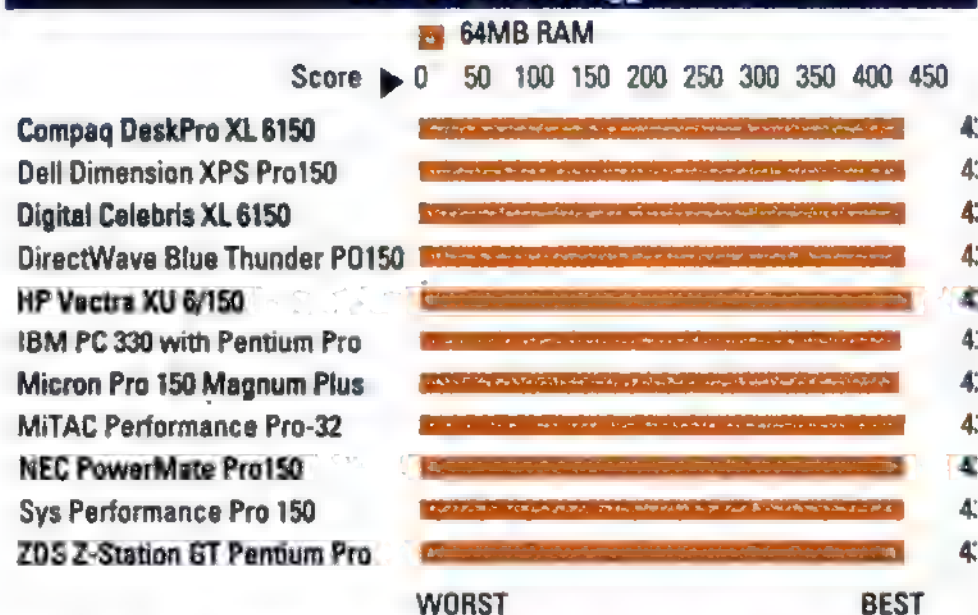
C COMPILER



CPU MARK₁₆



CPU MARK₃₂



AUTOCAD TESTS

Our **AutoCAD** tests (using AutoCAD R13c3) exercise a broad range of system functions, including the CPU's integer and floating-point capabilities and disk and video subsystem capabilities. There are three key areas of our AutoCAD test script: opening drawing files (including both 2-D and 3-D drawings), performing 2-D manipulations (including new entity additions, entity deletions, undo commands, regens, and zooms and pans), and performing 3-D manipulations (including 3-D view rotations and alterations, the hide command, 3-D move operations, and a variety of rendering variations).

ADOBE PHOTOSHOP TESTS

Testing in Adobe Photoshop involves the use of two filters. The Lighting Effects filter allows application of up to 16 different light sources on an image. Three different types of lights and five lighting styles are possible. We tested with default spotlight settings. The **Photoshop Lighting Effects** tests stress floating-point processing capability and are each applied to an 18.5MB TIFF image. The Gaussian Blur filter blurs a selection by an adjustable amount. This filter adds low-frequency detail and can produce a hazy

effect. For our **Photoshop Gaussian Blur** tests, we apply a blur of radius 25. We use Adobe Photoshop, Version 3.0.4, for these tests.

C COMPILER TESTS

For our **C Compiler** tests, we use the World Wide Web Consortium (W3C) Reference Library Benchmark. This consists of a set of C source code modules, largely platform-independent, which may be used to build World Wide Web servers, clients, and proxies. The W3C library is provided by CERN and has 119 files containing 1.1 million bytes of software source code. The programs were compiled into a 32-bit DLL library with Version 7.20 of Symantec's C++ development environment running under Windows NT 3.51.

CPUMARK₁₆ AND CPUMARK₃₂

The CPUmark₁₆ and CPUmark₃₂ scores indicate the speed of a PC's processor subsystem (which includes the CPU, L2 cache, and system memory) under 16- and 32-bit Windows operating systems. WinBench 96 bases these scores on large instruction mixes that emulate the CPU activity of real-world applications. We run these tests only on the 64MB configurations of the systems.

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WORKSTATIONS

Affordable workstation performance is now a reality. New from Micron—the Magnum Plus Pro200 workstation is the most advanced system available today. It combines exceptional Micron engineering with Intel's advanced Pentium® Pro processor, and Windows® NT. The result is the fastest, most reliable system on the market. Where else would you expect to find this kind of quality and engineering except from Micron—the technology leader.



MAGNUM PLUS PRO200

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- 6X SCSI-2 CD-ROM drive, 3.5" floppy drive
- SoundBlaster™ 16 stereo sound & speakers
- PCI 64-bit video, MPEG, 2MB EDO
- Tool-free mini-tower or desktop
- Microsoft® Mouse, 104-key keyboard
- Microsoft Windows NT Workstation 3.51 CD
- Microsoft Office Pro 95 & Bookshelf 95 CDs
- 5-year/3-year Micron Power™ warranty*



- A** • 32MB RAM • 2GB Fast SCSI-2 hard drive
• 15" Micron 15FGx, .28dp (13.7" viewable)
\$5,199 Business lease \$170/month
- B** • 64MB RAM • 4GB Fast SCSI-2 hard drive
• 17" Micron 17FGx, .28dp (15.8" viewable)
\$7,099 Business lease \$232/month
- C** • 128MB RAM • 9GB Fast SCSI-2 hard drive
• 21" Micron 21FGx, .28dp (20.0" viewable)
\$11,799 Business lease \$379/month



WHY SETTLE FOR

"The Millennia is nothing short of the best all-around PC available on the market today."

PC Magazine, April 25, 1995

With 150MHz of screaming Pentium processor horsepower, Micron's P150 Millennia races far ahead of all established benchmarks into a whole new universe of unbridled computing performance. And with new memory technologies like EDO memory and pipelined burst cache, this proven champion is optimized to perfection. The Millennia P150 is ready to run any application you want. Right now! There's no stopping the Micron Millennia. So what's stopping you?



ANYTHING LESS?

MILLENNIA P150

- Intel 150MHz Pentium® processor
- 256K pipelined burst cache, flash BIOS
- 6X EIDE CD-ROM drive, 3.5" floppy drive
- SoundBlaster™ 16 stereo sound & speakers
- PCI 64-bit video, MPEG, 2MB EDO
- Tool-free mini-tower or desktop
- Microsoft® Mouse, 104-key keyboard
- Microsoft Windows® 95 CD
- 5-year/3-year Micron Power™ warranty*



- A** • 8MB EDO RAM • 850MB EIDE hard drive
• 15" Micron 15FGx, .28dp (13.7" viewable)
• Microsoft Works 95 CD

\$2,299

Business lease \$82/month

- B** • 16MB EDO RAM • 1.2GB EIDE hard drive
• 15" Micron 15FGx, .28dp (13.7" viewable)
• Microsoft Office Pro 95 & Bookshelf 95 CDs

\$2,699

Business lease \$96/month

- C** • 32MB EDO RAM • 1.6GB EIDE hard drive
• 17" Micron 17FGx, .26dp (15.8" viewable)
• Microsoft Office Pro 95 & Bookshelf 95 CDs

\$3,599

Business lease \$123/month

- With 166MHz Pentium processor.....add \$200



January 9, 1996
MILLENNIA LINE



December, 1995
P133 MILLENNIA

MILLENNIA PLUS P166

- Intel 166MHz Pentium processor
- 256K pipelined burst cache, flash BIOS
- PCI 32-bit Ultra SCSI Fast-20 controller
- 6X SCSI-2 CD-ROM drive, 3.5" floppy drive
- SoundBlaster 16 stereo sound & speakers
- PCI 64-bit video, MPEG, 2MB EDO
- Tool-free mini-tower or desktop
- Microsoft Mouse, 104-key keyboard
- Microsoft Windows 95 CD
- Microsoft Office Pro 95 & Bookshelf 95 CDs
- 5-year/3-year Micron Power™ warranty*



- A** • 16MB EDO RAM • 1GB Fast SCSI-2 hard drive
• 15" Micron 15FGx, .28dp (13.7" viewable)

\$3,299

Business lease \$112/month

- B** • 32MB EDO RAM • 2GB Fast SCSI-2 hard drive
• 15" Micron 15FGx, .28dp (13.7" viewable)

\$4,199

Business lease \$143/month

- C** • 64MB EDO RAM • 4GB Fast SCSI-2 hard drive
• 17" Micron 17FGx, .26dp (15.8" viewable)

\$6,099

Business lease \$199/month

- With 150MHz Pentium processor.....subtract \$200



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pentium

P266 PowerServer SMP, Micron offers a complete range of dependable products to suit every need.

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- Tool-free mini-tower or desktop
- Microsoft Mouse, 104-key keyboard
- Microsoft Windows 95 CD
- 5-year/3-year Micron Power™ warranty*

- A** • 8MB EDO RAM • 850MB EIDE hard drive
• 15" Micron 15FGx, .28dp (13.7" viewable)
• Microsoft Works 95 CD

\$1,899

Business lease \$68/month

- B** • 16MB EDO RAM • 1.2GB EIDE hard drive
• 15" Micron 15FGx, .28dp (13.7" viewable)
• Microsoft Office Pro 95 & Bookshelf 95 CDs

\$2,299

Business lease \$82/month

- With 133MHz Pentium processor.....add \$100

POWERSTATION LX P75

- Intel 75MHz Pentium processor
- 8MB EDO RAM • 850MB EIDE hard drive
- 3.5" floppy drive, flash BIOS
- PCI 64-bit graphics accelerator (1MB)
- 15" Micron 15FGx, .28dp (13.7" viewable)
- Tool-free mini-tower or desktop
- Microsoft Mouse, 104-key keyboard
- Microsoft Windows 95
- Microsoft Works 95
- 5-year/3-year Micron Power™ warranty*

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- Tool-free mini-tower or desktop
- Microsoft® Mouse, 104-key keyboard
- Microsoft Windows® 95 CD
- Microsoft Works 95 CD
- Microsoft Scenes: Sports Extremes; Microsoft Bob™ CD; Microsoft Encarta 96 CD; Quicken® Deluxe Edition CD; Microsoft Dangerous Creatures CD; Microsoft Golf Multimedia CD; Trial subscriptions for Compuserve™, Prodigy™ and America On-Line™

- 5-year/3-year Micron Power™ warranty*

\$1,999



May 16, 1995
P90 HOME MPC



July 1995
P90 HOME MPC

HOME MPC Pro P150

- Intel 150MHz Pentium processor
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- 16MB EDO RAM • 1.2GB EIDE hard drive
- 6X EIDE CD-ROM drive, 3.5" floppy drive
- SoundBlaster 16 stereo sound & speakers
- 28.8 fax/modem, speakerphone, voice mail
- PCI 64-bit video, MPEG, 2MB EDO
- 17" Micron 17FGx, .26dp (15.8" viewable)
- Tool-free mini-tower or desktop
- Microsoft Mouse, 104-key keyboard
- Microsoft Windows 95 CD
- Microsoft Office Pro 95 & Bookshelf 95 CDs
- Microsoft Scenes: Sports Extremes; Microsoft Bob CD; Microsoft Encarta 96 CD; Quicken Deluxe Edition CD; Microsoft Dangerous Creatures CD; Microsoft Golf Multimedia CD; Trial subscriptions for Compuserve, Prodigy and America On-Line.

- 5-year/3-year Micron Power™ warranty*

\$3,199

- With 133MHz Pentium processor.....subtract \$100
- With 166MHz Pentium processor.....add \$200



*MICRON POWER™ WARRANTY & SUPPORT

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- 1-year optional on-site service agreement included
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- 30-day money-back policy
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All sales are subject to Micron's standard limited warranties and terms and conditions of sale. Copies of the limited warranties may be obtained by calling Micron.

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During testing, the Celebris XL 6150 was a fairly solid performer, posting average scores on most of our tests. It posted lower than average scores, however, on our Photoshop Gaussian Blur tests at both 32MB and 64MB as well as on the Photoshop Lighting Effects test with 32MB of RAM.

With its three-year parts-and-labor warranty, on-site service for the first year, and 24-hour, 7-day toll-free technical support (available around the world), Digital is a front-running service provider. The company was also top-rated on *PC Magazine's* Service and Reliability Survey.

Celebris XL 6150. Street price: \$8,316. Digital Equipment Corp., Maynard, MA; 800-216-8115, 508-642-6400; fax, 800-388-3228; <http://www.pc.digital.com>. Circle 447 on reader service card.

DirectWave Inc.

Blue Thunder P0150

DirectWave's Blue Thunder P0150 is marketed as a corporate Windows NT workstation or server. The system's price (\$7,499 street with 64MB of RAM; \$6,599 with 32MB) is reasonable given its components, but its performance test results ranged from fastest to slowest, depending on application and memory configuration. The Blue Thunder P0150 was unable to load Microsoft Office 95 successfully, so we don't report scores for either the Word or Excel tests. (The problem should be fixed by the time you read this.)

The DirectWave system came in a tower case and used an ASUSTek motherboard. Other components include a 2GB Fast/Wide SCSI-2 hard disk, a Matrox MGA Millennium graphics card with 2MB of WRAM, and a MAG 17-inch monitor. A 6X CD-ROM drive is also included; there is no audio in the system, either on a card or integrated on the motherboard.

The Blue Thunder P0150 posted uneven test results with scores that ranged from slowest to fastest in its class. On the AutoCAD and C Compiler tests, it was the fastest tested with 64MB of RAM; with 32MB, however, its AutoCAD result was the slowest and its C Compiler score was average. During Photoshop testing with 32MB, the unit had a faster-than-average score on our Gaussian Blur test; with 64MB, the result was average. During

SUMMARY OF FEATURES

Pentium Pro Workstations

Price For machines sold through resellers, assume street prices will be 15 to 20 percent lower than list prices. Some companies factor this discount into their quoted prices; in such cases, we indicate that the cited price is a street price

Processor All systems tested for this roundup used 150-MHz Pentium Pro processors.

Installed RAM Unlike many Pentium PCs, the Pentium Pro workstations we tested cannot use EDO DRAM because this type of memory is not supported by the Pentium Pro's PClset chip set. One system here used ECC (error-correction code) RAM, which can detect and correct single-bit errors.

Hard disk interface EIDE denotes Enhanced IDE, an extension to IDE that supports faster transfer rates, higher disk capacities, and mass-storage devices other than hard disks. Fast ATA-2 denotes Seagate's EIDE-like specification for increased transfer rates and larger capacities. SCSI-3 (sometimes called Ultra SCSI or Fast-20) supports peak transfer rates of 40 MBps.

Graphics adapter (and memory type) VRAM and

the new WRAM (Window RAM—not associated with Microsoft Windows) graphics memory types are faster than DRAM because both can move data in and out simultaneously

Screen diagonal: claimed/actual (inches) The claimed display size represents the vendor's claimed size of the monitor. The actual viewing area is the diagonal measurement of the screen itself. In many cases, the claimed size is smaller than the actual viewing area.

CD-ROM drive interface ATAPI is a specification that enables CD-ROM drives to act much like hard disks, which allows them to be connected to Enhanced IDE interfaces. Proprietary drives connect to a special connector on a sound board

Multiprocessor socket indicates whether or not the system has an additional socket to accommodate a second processor.

Expansion-bus slots PCI cards may share a backplane with ISA cards, meaning that you can use one or the other, but not both simultaneously. These shared slots are listed as PCI/ISA.

Lighting Effects testing, its score was average at 32MB but slower than average at 64MB.

DirectWave sells the system with a one-year-parts, lifetime-labor warranty. On-site service costs \$45 for one year, and technical support is limited to weekday business hours.

Blue Thunder P0150. Street price: \$7,499. DirectWave Inc., Ontario, CA; 800-882-8108, 909-390-8098; fax, 909-390-8061. Circle 448 on reader service card.

Hewlett-Packard Co.

HP Vectra XU 6/150



Hewlett-Packard Co.'s Vectra XU 6/150—our Editors' Choice—is easily the performance champ of this roundup. Aptly positioned as a high-performance system for medium- to large-size companies, the Vectra XU costs \$8,600 (street) with 64MB of RAM; with 32MB, the price is \$7,100. It

incorporates several technologies, including dual-processor capability, on HP's own motherboard with great results. This machine's class-leading performance and HP's reputation and record for top-quality service and support make the Vectra XU a great bet for anyone who wants a high-powered Pentium Pro workstation.

HP's motherboard has sockets for two CPUs (a second 150-MHz Pentium Pro is a \$1,400 option), and the machine is the only one here that is dual-CPU-capable. It is also the only one with a 128-bit memory path. DIMM-form-factor memory is required, and ECC memory is supported and was included on our test system.

The Vectra XU's tower case also held a 2GB Fast SCSI-2 hard disk, a Matrox MGA Millennium graphics card with 2MB of WRAM, and a 17-inch monitor. A Creative Labs Vibra 16 FM audio chip, which works in conjunction with the unit's quad-speed CD-ROM drive, is integrated on the motherboard. An HP 10/100-Mbps Ethernet

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CIRCLE 015 ON READER SERVICE CARD

*3 years - parts; 1 year - labor

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SUMMARY OF FEATURES

Pentium Pro Workstations

PC MAGAZINE
EDITORS' CHOICE

■ YES ■ NO In alphabetical order by company	Compaq DeskPro XL 6150	Dell Dimension XPS Pro150	Digital Celebris XL 6150	DirectWave Blue Thunder P0150	HP Vectra XU 6/150	IBM PC 330 with Pentium Pro Processor	Micron Pro 150 Magnum Plus	MITAC Performance Pro-32
Price of tested configuration (64MB RAM)	\$8,999 (street)	\$7,029 (street)	\$8,316 (street)	\$7,499 (street)	\$8,600 (street)	\$7,649 (street)	\$8,497 (street)	\$5,999 (street)
Processor	Pentium Pro/150	Pentium Pro/150	Pentium Pro/150	Pentium Pro/150	Pentium Pro/150	Pentium Pro/150	Pentium Pro/150	Pentium Pro/150
Installed RAM	64MB	64MB	64MB	64MB	64MB ECC	64MB	64MB	64MB
Hard disk manufacturer and model	IBM DPES-31080	Seagate ST32140A	Seagate ST31230N	Seagate ST32550W	Seagate ST32550N	Quantum Fireball 1080A	Quantum Grand Prix XP32151S	Seagate ST32550N
Capacity and interface	1GB Fast SCSI-2	2GB Fast ATA-2	1GB SCSI-2	2GB Fast/Wide SCSI-2	2GB Fast SCSI-2	1GB Fast ATA-2	2GB SCSI-3	2GB Fast SCSI-2
Monitor manufacturer and model	Compaq QVision 172	Dell D1726S-HS	Digital FR-PCXCV-AC	MAG InnoVision DX17F	HP D2817A	IBM P70	Hitachi Accuvue XU	MITAC L1564-PDM
Screen diagonal: claimed/actual (inches)	17, 16	17, 15.5	15, 14.2	17, 16	17, 15.5	17, 16	21, 20.5	15, 13.8
Graphics adapter	Matrox MGA Millennium	Number Nine Imagine 128	Matrox MGA Millennium	Matrox MGA Millennium	Matrox MGA Millennium	Matrox MGA Millennium	Number Nine Imagine 128 Pro	Diamond Stealth64 Video 3240
Memory on graphics adapter	4MB WRAM	4MB VRAM	2MB WRAM	2MB WRAM	2MB WRAM	4MB WRAM	8MB VRAM	2MB VRAM
CD-ROM drive	Sony CRD-254SH	TEAC CD-50E	Toshiba XM-5302B	TEAC CD-50E	Sony CDU-76S	TEAC CD-50E	Plextor PX-63CS	Plextor PX-63CS
Drive speed and interface	4X SCSI-2	6X ATAPI	4X ATAPI	6X ATAPI	4X SCSI-2	6X ATAPI	6X SCSI	6X SCSI
Motherboard Components								
Motherboard manufacturer	Compaq	Intel	Digital	ASUSTek	HP	Intel	Micronics	ASUSTek
Chip set manufacturer and model	Intel 82450GX	Intel 82450KX	Intel 82450GX	Intel 82450KX	Intel 82450KX	Intel 82450KX	Intel 82450KX	Intel 82450KX
BIOS manufacturer and version (or date)	Compaq (10/17/95)	AMI X03	Phoenix 4.05	AMI (10/10/94)	Phoenix SGG.22.01	IBM (9/20/95)	Phoenix 4.50	AMI (10/10/94)
Multiprocessor socket	■	■	■	■	■	■	■	■
Expendability								
Maximum RAM	512MB	128MB	512MB	512MB	256MB	128MB	256MB	512MB
Expansion-bus slots	3 EISA, 1 PCI, 1 PCI/EISA	2 ISA, 3 PCI, 1 PCI/ISA	3 ISA, 2 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA	3 ISA, 2 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA
Accessible drive bays (5.25", 3.5")	3, 0	3, 1	3, 1	4, 1	3, 2	3, 1	3, 1	4, 1
Internal drive bays (5.25", 3.5")	0, 2	0, 2	0, 1	0, 4	0, 2	0, 2	0, 2	2, 0
Power-supply wattage	240W	200W	300W	300W	200W	200W	200W	250W
Parallel, serial, mouse ports	1, 2, 1	1, 2, 1	1, 2, 1	1, 2, 0	1, 2, 1	1, 2, 1	1, 2, 1	1, 2, 0
Service and Support								
7-day, 24-hour live technical support	■	■	■	■	■	■	■	■
Standard warranty on parts/labor	3 years/3 years	3 years/1 year	3 years/3 years	1 year/lifetime	3 years/3 years	3 years/3 years	3 years/1 year	1 year/1 year
On-site service charge (first year)	Included	Included	Included	\$45	Included	Included	Included	\$99

PCI card is also included.

The Vectra XU's test scores were the fastest or second fastest on many tests, including AutoCAD, C Compiler, Excel, Photoshop, and Word. Its CPUmark₁₆ scores were average, but its CPUmark₃₂ scores (with 64MB of RAM) were the highest of this roundup.

Hewlett-Packard sells the Vectra XU 6/150 with a three-year warranty. On-site service is included for the first year, and technical support is available seven days a week. HP also received a grade of A on our Service and Reliability survey.

HP Vectra XU 6/150. Street price: \$8,600. Hewlett-Packard Co., Palo Alto, CA; 800-752-0900, 303-635-1000; fax, 810-357-1317; <http://www.hp.com>. Circle 449 on reader service card.

IBM PC Co.

IBM PC 330 with Pentium Pro Processor

Targeted for high-end engineering and scientific users, IBM PC Co.'s PC 330 with Pentium Pro Processor is a solid performer. Priced at \$7,649 (street) with 64MB of RAM (\$5,367 with 32MB of RAM), the PC 330 posted consistently average scores on performance tests. IBM's comprehensive warranty and support plan and its top rating on our Service and Reliability surveys make the PC 330 a good choice for those who plan to buy their first Pentium Pro workstation for demanding Windows NT applications.

Based on an Intel motherboard, the mini-tower PC 330 came with a 1GB Fast ATA-2 hard disk, a Matrox MGA Millen-

nium graphics card with 4MB of WRAM, and a 17-inch monitor. A 6X CD-ROM drive is standard, but no audio is included. IBM's OS/2 Warp Connect is bundled with the system, as is Windows NT (all performance testing was conducted under Windows NT).

The PC 330's performance test results were on a par with the competitions', with either 32MB or 64MB of RAM installed.

IBM sells the IBM PC 330 with Pentium Pro Processor with a three-year parts-and-labor warranty and one year of free on-site service. It supports the unit with toll-free technical support around the clock, seven days a week. One of four vendors to receive a grade of A on PC Magazine's Service and Reliability survey, IBM remains a safe source for buyers concerned about after-sale support.

Pentium Pro Workstations

NEC PowerMate Pro150	Sys Performance Pro 150	ZDS Z-Station GT Pentium Pro
\$7,969 (street)	\$7,894 (street)	\$7,234 (street)
Pentium Pro/150	Pentium Pro/150	Pentium Pro/150
64MB	64MB	64MB
Western Digital Caviar 31600	Quantum Atlas XP34300W	Western Digital Caviar 31600
1.5GB EIDE	Two 4.1GB Fast/Wide SCSI-2 disks	1.5GB EIDE
NEC MultiSync KV 17	MAG InnoVision DX17F	Nokia ZCM-1740
17, 15.3	17, 16	17, 16
Matrox MGA Millennium	Diamond Stealth64 Video 3240	Diamond Stealth64 Video 2201
4MB VRAM	2MB VRAM	2MB DRAM
TEAC CD-56E	TEAC CD-56E	Toshiba KM-5302B
6X ATAPI	6X ATAPI	4X ATAPI
Intel	ASUSTek	ZDS
Intel 82450KX	Intel 82450KX	Intel 82450KX
AMI 1.06	AMI (10/10/94)	AMI 1.06
128MB	512MB	128MB
2 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA
3, 1	6, 1	3, 1
0, 2	0, 3	0, 2
200W	250W	200W
1, 2, 1	1, 2, 0	1, 2, 1
■	■	■
3 years/3 years Included	Varies/1 year \$95	3 years/3 years Included

IBM PC 330 with Pentium Pro Processor. Street price: \$7,649. IBM PC Co., Somers, NY; 800-426-2968; fax, 800-426-4329; <http://www.ibm.com>. *Circle 450 on reader service card.*

Micron Electronics Inc.

Pro 150 Magnum Plus

Micron Electronics' Pro 150 Magnum Plus is well equipped for its target market as a high-end graphics station for DTP and CAD/CAM applications. The Pro 150 Magnum Plus (\$8,497 street price with 64MB of RAM; \$7,297 with 32MB) is also a solid performer and a great value: The prices include a 21-inch monitor and an 8MB graphics card. (Lower the above prices by \$1,450 for a 17-inch monitor and 4MB graphics card.)

In addition to its 21-inch Hitachi monitor and Number Nine Imagine 128 Pro graphics adapter with 8MB of VRAM, the Pro 150 Magnum Plus comes with a 2GB SCSI-3 hard disk, a 6X CD-ROM drive, and a Creative Labs Sound Blaster AWE32 audio card with FM and wave-table sound. Microsoft Office 95 is also included. This mini-tower system utilizes a Micronics motherboard.

The Pro 150 Magnum Plus posted better-than-average results on our Excel and Photoshop Gaussian Blur tests with 32MB of RAM, and average times on the AutoCAD, C Compiler, and Word tests. With 64MB, the Micron unit garnered average results on the CPUmark₃₂ test and the Photoshop Lighting Effects and Gaussian Blur tests. But with 32MB of RAM, the unit was slower than average on our Photoshop Lighting Effects test.

Micron sells the Pro 150 Magnum Plus with a three-year-parts, one-year-labor warranty, on-site service, and toll-free technical support seven days a week.

Pro 150 Magnum Plus. Street price: \$8,497. Micron Electronics Inc., Nampa, ID; 800-388-6334, 208-463-3434; fax, 208-463-3424; <http://www.mei.micron.com>. *Circle 451 on reader service card.*

MiTAC

MiTAC Performance Pro-32

The MiTAC Performance Pro-32 is sold by value-added resellers and system integrators as a Windows NT server or workstation. It is typically custom-configured for specific applications. Our test system (\$5,999 street price with 64MB RAM; \$4,999 with 32MB) was the lowest-priced Pentium Pro model in this review. But the unit posted lower-than-average scores on several of our performance tests.

Housed in a full-tower case and using an ASUSTek motherboard, the Performance Pro-32 features a 2GB Fast SCSI-2 hard disk, a Diamond Stealth64 VRAM 3240 graphics adapter with 2MB of VRAM, and a 15-inch monitor. Other equipment includes a 6X CD-ROM

drive and a Creative Labs Sound Blaster 16 Value audio card with FM sound.

With 64MB of RAM, the Performance Pro-32 posted average scores on the CPUmark₁₆ and CPUmark₃₂ tests, but it was slower than average on the Excel and Word tests. Its scores with 32MB of RAM were average on the AutoCAD, C Compiler, and Photoshop tests; its Excel test score, however, was slower than average.

MiTAC backs this system with a one-year parts-and-labor warranty. On-site service is available for \$99 for one year, but technical support is limited to weekday business hours.

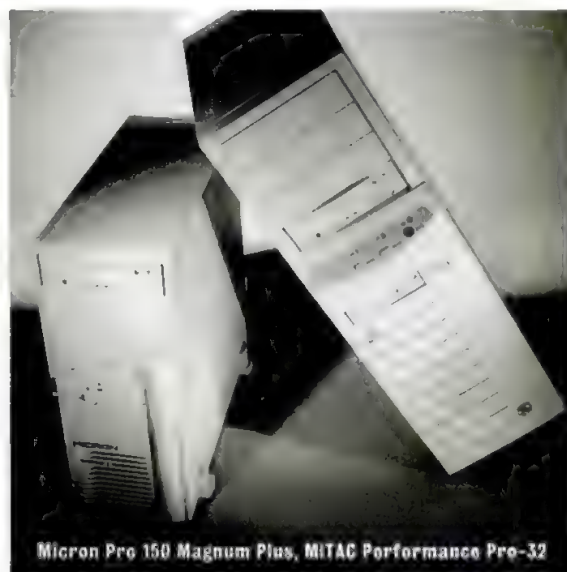
MiTAC Performance Pro-32. Street price: \$5,999. MiTAC, Fremont, CA; 800-756-9888, 510-656-3333; fax, 510-440-3777. *Circle 452 on reader service card.*

NEC Technologies Inc.

PowerMate Pro150

NEC Technologies' PowerMate Pro150 (\$7,969 street price as configured; \$6,669 with 32MB of RAM) is an average-performing 150-MHz Pentium Pro system. Targeted at early adopters and low-level Unix users, the PowerMate Pro150 is positioned for financial, CAD/CAM, scientific visualization, and software development applications. Backed by strong service and support, the system is a good value for its price and performance.

Using an Intel motherboard in a mini-tower case, the PowerMate Pro150's



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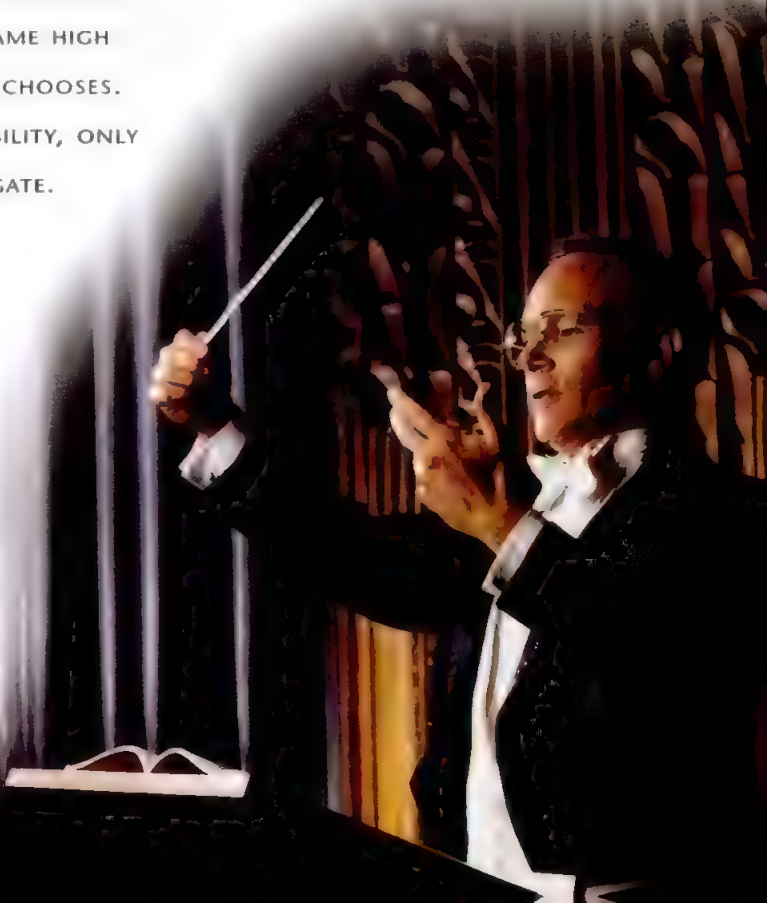
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CIRCLE 271 ON READER SERVICE CARD



standard components include a 1.5GB EIDE hard disk and a Matrox MGA Millennium graphics board with 4MB of VRAM. We also received a 17-inch NEC MultiSync XV17 monitor with our test unit (\$700; included in the above prices). For loading software and multimedia applications, the system has a 6X CD-ROM drive and a Creative Labs Sound Blaster AWE32 audio card with FM and wavetable sound and a pair of stereo speakers. Other standard equipment includes a 3Com 10/100-Mbps PCI Ethernet card and SoftPeg MPEG decoder software.

Aimed at users of NEC's Versa notebook PCs, an optional VersaBay II adapter cage (under \$100 and available by the time you read this) lets you use such devices as removable hard disks from Versa notebooks. A PC Card adapter is also available. The PowerMate Pro150 also features a serial infrared sensor.

The PowerMate Pro150 posted average scores on most tests. It was, however, faster than average on both of the Excel tests and slower than average on the Photoshop Lighting Effects test with 64MB.

Backed by a three-year warranty that includes on-site service for one year and 24-hour, 7-day toll-free technical support, the PowerMate Pro150 should assuage the support concerns of those wondering about buying new technology.

PowerMate Pro150. Street price: \$7,969. NEC Technologies Inc., Mountain View, CA; 800-632-4636, 508-264-8000; fax, 800-366-0476; <http://www.nec.com>. *Circle 453 on reader service card.*

Sys Technology Inc.

Sys Performance Pro 150

Sys Technology positions its Sys Performance Pro 150 for corporate power users and professionals in small or home businesses who need a lot of power. The Performance Pro 150 (\$7,894 street price with 64MB of RAM; \$6,899 with 32MB) was loaded with disk storage—8.2GB in all—and was an average performer on our tests.

The Sys unit came in a tower case with an ASUSTek motherboard, two 4.1GB



Fast/Wide SCSI-2 hard disks, a Diamond Stealth 64 VRAM 3240 OEM graphics card with 2MB of VRAM, and a MAG 17-inch monitor. There was no audio card in the tested system but it did include a 6X CD-ROM drive. It also features a motherboard tray and expansion-card case that slides out for easy servicing.

The Performance Pro 150 posted better-than-average scores on both Photoshop tests with 32MB of RAM. The system's other test scores were mostly average, although its Excel results at 32MB and 64MB were slower than average. Sys configures this machine with two hard disks; it claims that users will realize a performance gain on disk-intensive applications. We report results using only one hard disk for cross-system comparability. (Informal testing conducted with two hard disks showed a negligible performance improvement.)

Sys Technology's warranty on parts depends on the individual warranties of the original component manufacturers. A one-year warranty on labor is standard, and on-site service is available for an additional \$95 for the first year. Technical support is available from 11:30 to 9:00 (eastern time), Monday through Friday.

Sys Performance Pro 150. Street price: \$7,894. Sys Technology Inc., Cypress, CA; 800-613-9963, 714-821-3900; fax, 714-821-9592; <http://www.systechology.com>. *Circle 454 on reader service card.*

Zenith Data Systems

Z-Station GT Pentium Pro

Zenith Data Systems' Z-Station GT Pentium Pro is competitively priced at \$7,234 with 64MB of RAM and \$5,829 with 32MB of RAM (street prices); its performance was mostly in line with that of other systems. ZDS targets this unit at people who want to run 32-bit CAD, imagery, and financial applications and need high capacity and high performance for high-end desktops or entry-level workstations.

Based on an Intel motherboard, the Z-Station GT Pentium Pro mini-tower came with a 1.5GB EIDE hard disk, a Diamond Stealth64 Video 2201 graphics card with 2MB of DRAM, and a ZDS/Nokia 17-inch monitor. A quad-speed CD-ROM drive was included, but no audio card. By the time you read this, the unit will ship with a 2.1GB hard disk (with a price increase).

The Z-Station GT Pentium Pro's performance was on a par with other units' on most measures. With 32MB, however, the unit posted the slowest score of all units tested on our Word tests, and it tied for last place on our Excel tests.

ZDS provides a three-year warranty; first-year, next-business-day, on-site service; and 24-hour, toll-free technical support.

Z-Station GT Pentium Pro. Street price: \$7,234. Zenith Data Systems, Buffalo Grove, IL; 800-533-0331, 708-808-5000; fax, 800-472-7211; <http://www.zds.com>. *Circle 455 on reader service card.*



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CIRCLE 033 ON READER SERVICE CARD

150- AND 166-MHz PENTIUM PCs

The Powers That Be

New 150- and 166-MHz Pentiums: The chips of choice for mainstream PC users. BY ROBERT S. ANTHONY

Unlike many pieces of computer hardware, the Pentium chip has aged relatively well. It has successfully weathered torrents of criticism on issues ranging from the mundane (size, power, and heat) to the obscure (floating-point precision) and managed to earn itself the crown as the undisputed champion of IBM-compatible computing. This is no mean feat, given the demanding nature of veteran PC users.

Today, however, the Pentium processor is king of the hill no more. Intel's new Pentium Pro processor is far more sophisticated and much more powerful. In addition, processors from other CPU manufacturers will soon be able to rub shoulders with the Pentium in terms of performance.

There's no need to shed a tear for the former champ, however. Even though it now must settle into an unfamiliar role as Intel's *second* most powerful class of PC processor, the Pentium Classic still retains its title as the chip of choice for the average computer user. In its newest incarnations—introduced in January—as

150-MHz and 166-MHz CPUs, the Pentium helped the 31 powerful machines in this roundup reach new heights in terms of performance with Windows 95 applications.

POWER USERS' DILEMMA

Sometimes it pays to be a day late and a dollar short. If you're green with envy over your neighbor's glitzy new Windows 95-based 150-MHz Pentium Pro computer, guess what? The joke's on your neighbor: The grass is actually greener on your side of the fence.

PC Magazine was the first to point out that the Pentium Pro processor is designed for full 32-bit operating systems such as Windows NT. On 16-bit operating systems such as Windows 3.1 and even Windows 95 (the latter of which is a 32-bit operating system, but includes a good deal of 16-bit code for the sake of backward compatibility), a 150-MHz Pentium Pro system barely keeps pace with 166-MHz Pentium machines.



Yes, we were surprised too when we first noted this anomaly last summer (see the chart "Pentium Pros vs. Pentiums"). With Windows 95, your neighbor's Pentium Pro PC is like an expensive, supercharged sports car stuck in second gear. In order to achieve the best performance with Windows 95, the dollar-for-dollar choice is clearly a 166-MHz Pentium system.

WILY VETERANS

Pentium PCs are now inarguably mature products. Although this class of computers has come a long way from the power-guzzling 60-MHz and 66-MHz units with VL-Bus slots, extra fans, and gigantic price tags, the evolution has now slowed. In general, the 150-MHz and 166-MHz Pentium units reviewed here are very much like the 120-MHz and 133-MHz Pentium machines we reviewed in our issue of December 5, 1995.

A key difference between the two reviews may be the "tweak factor." In our previous Pentium PC roundup, vendors had little or no time to fine-tune their machines' performance with Windows 95. The operating system was released just days before we began testing these systems and vendors were basically stuck—for better or for worse—with whatever hardware drivers were packaged with Windows 95 itself.

In this roundup, however, it's clear that some manufacturers have done their homework and have configured these 150- and 166-MHz Pentium machines with the latest Windows 95 drivers they could obtain. The result is reflected in the record-breaking benchmark test scores logged by some of these machines.

IN THIS REVIEW

Acer America Corp.	138	Micron Electronics Inc.	156	Sys Technology Inc.	169
Caliber Computer Corp.	143	Mitsuba Corp.	157	USA Flex Inc.	169
CompuTrend Systems Inc.	150	NEC Technologies Inc.	158	US Computer Direct	170
Comtrade	150	PerComp Microsystems Inc.	158	Vektron	173
Dell Computer Corp.	152	PowerSpec	158	Zenith Data Systems	173
Digital Equipment Corp.	152	Quantex Microsystems Inc.	163	Zenon Technology Inc.	173
DTK Computer Inc.	153	Reason Technology Inc.	163	Editors' Choice	138
EPS Technologies Inc.	153	Robotech Inc.	164	Price/Performance Index	140
Gateway 2000 Inc.	154	Royal Computers Inc.	164	Performance Tests	146
IBM PC Co.	155	SAG Electronics	169	Summary of Features	153

HIGHLIGHTS

150- and 166-MHz Pentium PCs

The Pentium remains the processor of choice for mainstream business- and home-oriented applications.

Paired with Windows 95, these new 150- and 166-MHz Pentium PCs not only offer an incredible amount of bang for your buck, but they're also ready to take on future 32-bit computing applications with megahertz to spare.

It's not only speedier CPUs that translated into unprecedented levels of performance on our benchmark tests—optimized Windows 95 hardware drivers also contributed. This optimization was particularly evident in the areas of graphics and disk performance, where record-breaking scores on our Graphics WinMark 96

and Disk WinMark 96 tests were witnessed.

An 8X CD-ROM drive made its entry in this roundup through Comtrade's 3D Game Station 8X. But don't let the "8X" fool you: This Diamond drive did not perform well on our benchmark tests. Although its throughput was up to speed (rated at 1,200 KBps), its slow access time helped the Comtrade machine to a CD-ROM WinMark 96 score that was lower than those posted by most machines equipped with 6X drives.

128-bit graphics accelerators make an impact. Number Nine's Imagine 128 graphics board was used in each of the top four finishers on our Graphics WinMark 96 tests. This graph-

ics board has always been a strong performer on our tests, but its optimized Windows 95 driver made the difference in this review.

3-D accelerators on games/graphics boards were present in two of the machines here. But though these cards will work well with games software, they did not live up to our expectations on our benchmark tests. Both of the machines that used these cards produced below-average Graphics WinMark scores.

Asynchronous L2 cache has disappeared in this roundup. Once a popular choice of vendors because of its low price, asynchronous cache has been displaced by pipelined-burst and synchronous cache.

IN THIS ROUNDUP

For this roundup, we asked each vendor to supply us with a 150-MHz or 166-MHz Pentium PC with a preinstalled copy of Windows 95, 16MB of RAM, a 1GB or larger hard disk, a quad-speed or faster CD-ROM drive, a 16-bit sound card (or integrated sound subsystem), and speakers. The graphics card and monitor (15-inch minimum) had to support 1,024-by-768 resolution with 256 colors and a refresh rate of 75 Hz.

We received a total of 31 machines—23 166-MHz Pentium systems and eight 150-MHz Pentium units. Some vendors were not able to participate in this review because they did not have enough time to acquire the new 150- and 166-MHz Pentium processors, which were officially introduced by Intel on January 4, 1996.

Hewlett-Packard Co. plans to ship its new Vectra VL Series 4 150 and 166 by mid-January, 1996, but was too late to meet our testing deadlines. AST Research and Compaq Computer Corp. declined to participate.

MULTIMEDIA MILESTONES

It certainly didn't take long, but the quad-speed CD-ROM drive, once the speed demon of mainstream computing, now may be considered a dinosaur: The 6X CD-ROM drive is the new standard-bearer. With prices on quad-speed and

6X CD-ROM drives dropping quickly, the only reason that you'd want to buy a double-speed drive today is to keep dust out of an empty drive bay.

Of the 31 systems here, 20 came with 6X CD-ROM drives, and one system, the Comtrade 3D Game Station 8X, came with (as its name implies) an 8X drive. Unfortunately, though the Diamond 8X CD-ROM drive used in the Comtrade unit has a data transfer rate of 1,200 Kbps—well ahead of the 900-Kbps rating for a standard 6X CD-ROM drive—the system's CD-ROM WinMark 96 score still fell behind most of the other systems' in this roundup. This poor showing is because of the Diamond 8X CD-ROM drive's slow access time.

128-BIT GRAPHICS POWERHOUSE

The clear winners in the graphics performance category in this roundup were the four units that used Number Nine's Imagine 128 graphics board. The systems using this rather expensive PCI board (about \$699 with 4MB of VRAM when sold separately), which features a sophisticated 128-bit graphics acceleration engine, yielded Graphics WinMark 96 scores that were head and shoulders above the rest of the pack.

The machines with the Imagine 128 board were the CompuTrend Systems' Premio Triton P166, Dell Computer Corp.'s Dell Dimension XPS P166c, and

two of our Editors' Choice systems from SAG Electronics: the 166-MHz Pentium SAG STF 166 and the 150-MHz Pentium SAG STF 150.

Only a handful of other graphics boards were seen here. The vast majority of the systems reviewed used some version of the Diamond Stealth64 Video graphics board with VRAM (16 systems) or DRAM (1 system), but five other machines were set up with Matrox MGA Millennium WRAM-based graphics boards.

An STB PowerGraph 64 Video graphics board (with EDO DRAM) was used in Quantex Microsystems' QP5/166 SM-2, a Number Nine Vision 330 board was installed in USA Flex's Flex PT-166 Ultimate Multimedia Tower, and a Number Nine 9FX Motion 771 board was used in EPS Technologies' EPS Evolution P-166.

3-D ACCELERATORS ARRIVE

Not to be overlooked here are two machines which were optimized for 3-D graphics performance: the Comtrade 3D Game Station 8X and PowerSpec's PowerSpec*PC Reference Series P166.

The Comtrade unit used a VRAM-based Diamond Edge 3D 3240 graphics board with Nvidia's NV1 3-D graphics-acceleration chip set, while the PowerSpec system was configured with a DRAM-based Diamond Edge 3D 2120

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Gateway P5-166 XL SAG STF 150 SAG STF 166

These 31 PCs featuring Intel's newest and speediest Pentium processors—running at both 150 and 166 MHz—reach greater price/performance levels than ever before. From this very competitive group, we

found three that stood out from the crowd and awarded them with our Editors' Choice. Our first Editors' Choice recipient is the \$3,789 P5-166 XL from Gateway 2000. This machine was a price/performance leader, packed with enough goodies to keep even the most demanding multimedia maven happy. It features a 6X CD-ROM drive, an Ensoniq Soundscape wavetable sound card, Altec Lansing Surround Sound speakers, a 28.8-Kbps data/fax/voice modem, and a 17-inch monitor. You can complete this package with either Microsoft Office 95 Professional Edition and Gateway Generations II for business machines or an eight-CD bundle (featuring 45 titles) for home use.

Our other two Editors' Choice recipients are from SAG Electronics: the \$3,900 SAG STF 150 and the \$4,590 SAG STF 166. These systems were top-notch performers: Both turned in the best Winstone 96, Graphics WinMark 96, and Disk WinMark 96 scores of their respective CPU classes.

Both SAG PCs' hulking tower cases are loaded with powerful components.

board with SGS Thomson's STG200 3D graphics chip set. (Nvidia granted SGS Thomson marketing rights to its chip design.)

No, the numbers in your spreadsheets won't crunch any faster, but with either of these machines and a good joystick, the demons in the new wave of 3-D entertainment software will wish they had stayed home. In terms of real work, however, the 3-D acceleration chips will also come in handy with CAD-CAM and other 3-D rendering software.

These machines feature blazingly fast 7,200-rpm Fast/Wide SCSI-2 hard disks (a 4GB model for the STF 166 and a 2GB model for the STF 150), Number Nine Imagine 128 graphics accelerator cards, 512K of pipelined-burst SRAM, and a total RAM capacity of 512MB. SAG completes these packages with 17-inch ViewSonic monitors and Boca MV.34I modems.

We also tested two machines for this roundup worthy of honorable mentions: the \$3,899 Dimension XPS P166c from Dell Computer Corp. and the \$3,495 Square 5 LX-TR/IE-166 from Reason Technology. The Dimension XPS P166c won't disappoint on either performance or features: It garnered one of the top Winstone scores in this roundup, and it comes well equipped, with a 1GB hard disk, a 6X CD-ROM drive, and a 17-inch monitor. The LX-TR/IE-166 was one the most inexpensive Pentium/166 units tested, but it still packs a lot for the money, including a 6X CD-ROM drive, Altec Lansing ACS31 speakers with a subwoofer, and a 17-inch monitor.

ASYNCHRONOUS CACHE DISAPPEARS

In previous Pentium roundups, we saw systems with three different types of secondary cache: pipelined-burst, synchronous, and asynchronous. In this roundup, however, asynchronous cache disappeared. Asynchronous was at one time the most common type of cache used, mostly because it was the least-expensive cache choice (besides none at all). But our benchmark tests have shown that there's a penalty to pay for choosing asynchronous cache: Both

pipelined-burst and synchronous cache allow for faster cache burst timings, which translates into better overall system performance.

GADGETS AND GIZMOS

Among the interesting pieces of hardware we saw in this roundup was the Epson combination floppy disk drive/PC Card drive on the Mitsuba Premier System 166. The PC Card drive handles a single Type II or Type III device—a convenient feature if you want to share hard disks or other peripherals with a notebook PC.

Another system, NEC Technologies' PowerMate P166, offered a serial infrared port on the front of its case. With a compatible notebook or personal digital assistant and the included software, you can transfer files with the NEC unit without having to wrestle with special data-transfer cables.

A PENTIUM IN EVERY POT?

The Pentium Classic processor will remain the value choice for Windows 95 users for some time. With many software publishers well behind schedule in porting their Windows 3.1 titles to Windows 95, the Pentium will continue to provide—for now—a comfort zone for PC users. Even a 75-MHz Pentium has enough muscle to handle the first wave of Windows 95 software, but with the 150-MHz and 166-MHz units here, you should be able to keep pace with even the largest spreadsheets or fastest virtual villains.

Acer America Corp.

AcerPower P166

Acer America Corp.'s AcerPower P166 (\$3,895 street) is targeted at the corporate market through direct sales. This Pentium/166 machine should serve the market well: It comes with a 17-inch monitor, 256K of L2 cache, and a 1.5GB hard disk, which together helped the unit achieve mostly average benchmark test scores. Acer also sells the Acer Aspire line of home PCs through the retail channel and the AcerExtra line of entry-level business systems through value-added resellers.

The AcerPower P166 performed adequately on most of our benchmark tests. It



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CIRCLE 218 ON READER SERVICE CARD

Price/Performance Index: 150- and 166-MHz Pentium PCs

SAG Electronics' two entries into this roundup—both Editors' Choices—lead the pack on our price/performance scale. The \$4,590 SAG STF 166 is the clear leader, and the \$3,900 SAG STF 150 is less than ten points behind.

The SAG PCs are packed with today's most up-to-date components, including EDO DRAM, 512K of pipelined-burst external cache, and Fast/Wide SCSI-2 hard disks. The systems also have superfast graphics subsystems based on Number Nine Imagine 128 graphics cards, with 4MB of VRAM. These elements translated into top-notch performance for both PCs in their respective CPU classes.

Gateway 2000 also offers a contender, the Editors' Choice-winning \$3,789 P5-166 XL. A consistently strong performer, the P5-166 XL features such cutting-edge components as 256K of

pipelined-burst cache and a 1.5GB EIDE hard disk. The unit's speedy Matrox MGA Millennium graphics card came loaded with 4MB of WRAM.

The \$3,899 Dell Dimension XPS P166c is in the same league as Gateway's unit as far as features and performance are concerned. It combines 512K of L2 cache, a 1GB Fast ATA-2 hard disk, and a Number Nine Imagine 128 graphics card with 4MB of VRAM to produce average to above-average benchmark test scores.

The Reason Square 5 LX-TR/IE-166, which earned an honorable mention, comes closest to offering the ideal mix of price and performance. Priced at \$3,495, it offers a bountiful warranty: Three-year parts coverage and six-year labor coverage. It also boasts top-notch components and solid performance.

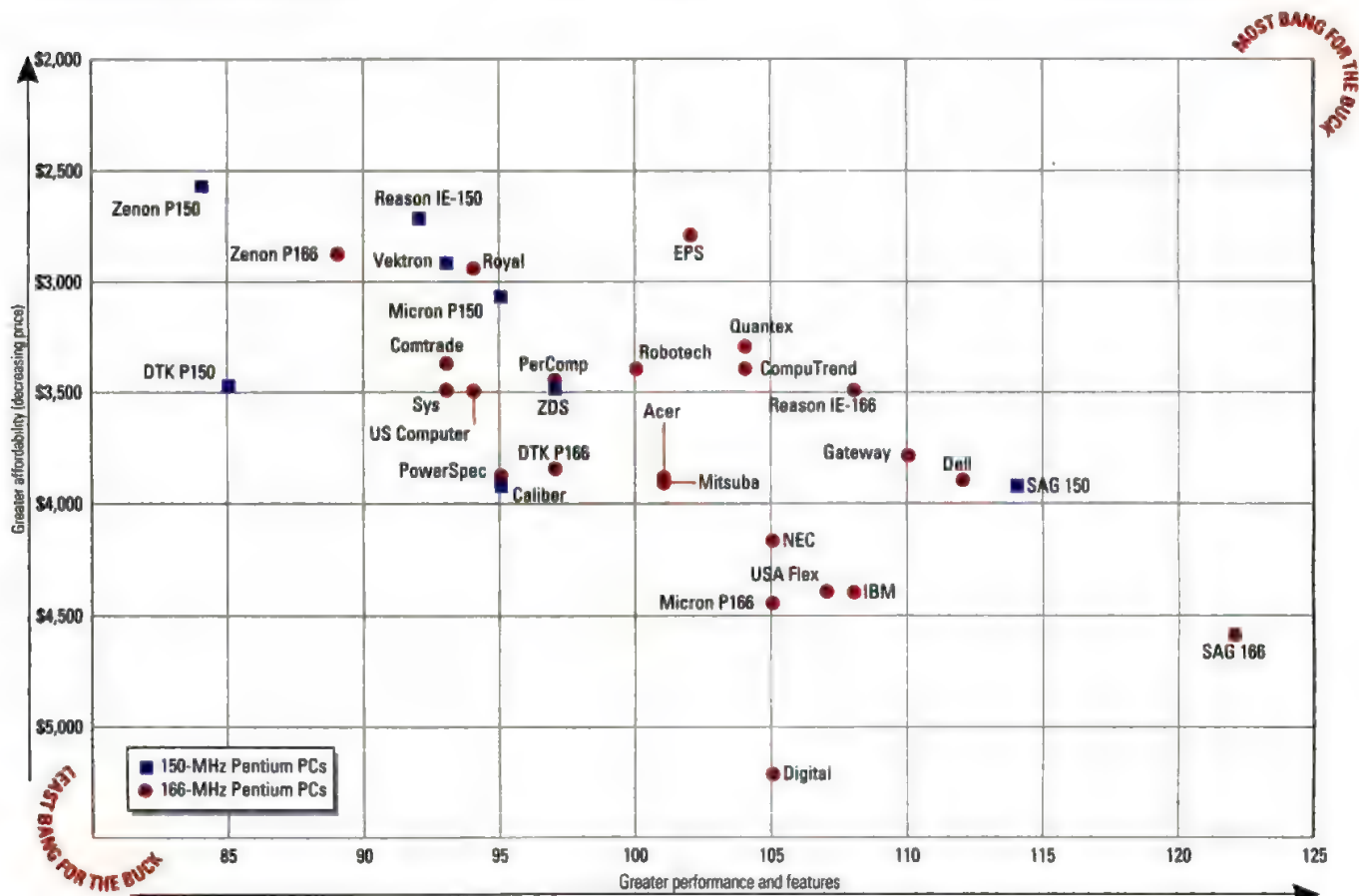
—Analysis written by Mary E. Behr

DATA POINTS

Benchmark tests scores comprise 45 percent of the performance/features score: Winstone 96 test results account for 42 percent, and CD-ROM WinMark 96 scores account for an additional 3 percent.

Overall features and components count for over 40 percent of our score: Some of the elements we consider when calculating this score are graphics memory size, sound card type, monitor size and refresh rates, and hard disk capacity. The vendor's service and warranty terms make up an additional 12 percent.

You can find price/performance index data in the Hardware Library of the Editorial Forum on PC MagNet under 04BANG96.txt and on the World Wide Web at <http://www.ziff.com/~pcmag/pclabs/pclabs.htm>.



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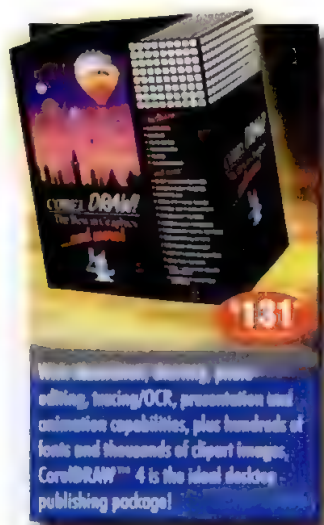
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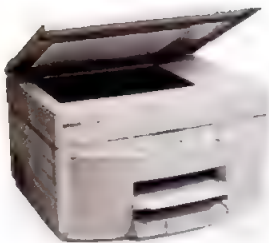
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earned average scores for its CPU class on our Winstone 96 and Disk WinMark 96 tests. Equipped with an S3 Vision968-based Diamond Stealth graphics accelerator card with 2MB of VRAM, the system produced a below-average Graphics WinMark 96 score.

The unit's CD-ROM WinMark 96 score was below average also, due to a Mitsumi quad-speed CD-ROM drive with one of the slowest access times in this roundup. This combination affected the unit's video-playback performance, causing some dropped frames on our Full-Screen Scaling and High-Quality Action Indeo video tests.

The unit's mini-tower case provides tool-free access and boasts swing-out internal drive cages to make adding or removing devices easier. A 16-bit Creative Labs sound card with FM and wavetable synthesis support and Yamaha speakers make up the remaining portion of the unit's multimedia hardware.

The AcerPower P166 comes with a three-year-parts, one-year-labor warranty, with the first year of on-site service included. Acer also provides 24-hour, 7-day, toll-free technical support.—*Anush Yeghazarian*

AcerPower P166. Street price: \$3,895. Acer America Corp., San Jose, CA; 800-733-2237, 408-432-6200; fax, 408-922-2933; http://www.acer.com/aac/.AATech_Support@acer.com. Circle 456 on reader service card.

Caliber Computer Corp.

Voyager III 150

Caliber Computer Corp.'s midtower PC, the Voyager III 150 (\$3,899 street), was built with government and university contracts in mind, as well as the needs of businesses. As a result, it offers plenty of storage space (thanks to its 2GB Fast/Wide SCSI-2 hard disk). The system posted highly competitive scores on our benchmark tests, including class-leading processor scores.

This 150-MHz Pentium system came with a quad-speed SCSI CD-ROM drive and a Diamond Stealth64 Video VRAM graphics card with 2MB of VRAM. Sound was handled by a 16-bit Creative Labs Sound Blaster 16 card with FM synthesis support and a set of MIDI Land speakers.

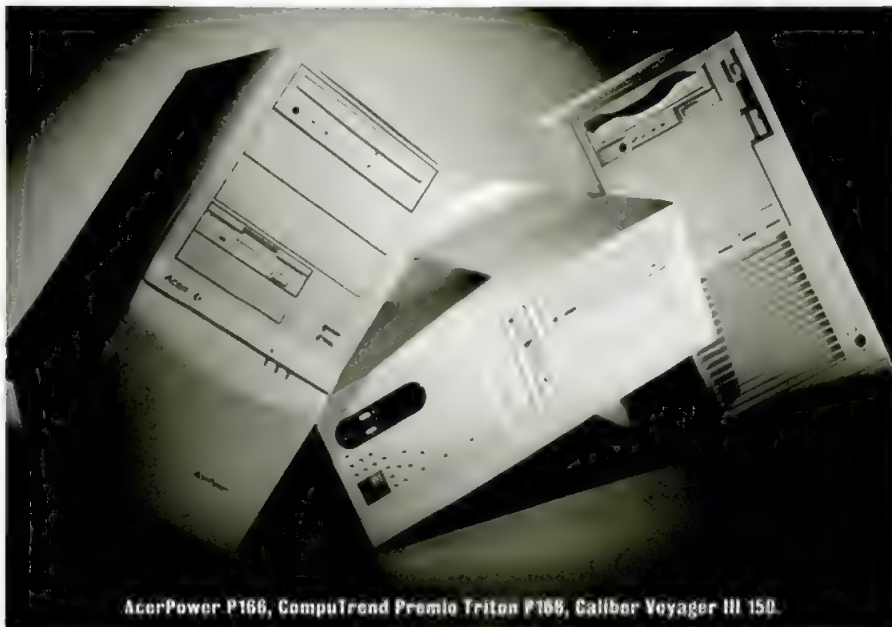
The unit performed well within its 150-MHz class, earning average scores on our Winstone 96, Graphics WinMark 96, and Disk WinMark 96 tests. Its 512K of L2 cache helped it post the best CPUmark₁₆ and CPUmark₃₂ scores of its class. The system also posted an average CD-ROM WinMark 96 score.

The Voyager III 150 comes with a two-year-parts, one-year-labor warranty, with one year of on-site service included.—*AY*
Voyager III 150. Street price: \$3,899. Caliber Computer Corp., Fremont, CA; 800-748-9834, 510-353-1220; fax, 510-354-2134; <http://www.bayscenes.com/caliber>. Circle 457 on reader service card.

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AcerPower P166, CompuTrend Premio Triton P166, Caliber Voyager III 150.

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What the Numbers Mean

WINSTONE 96 TESTS

The two SAG PCs—the SAG STF 150 and the SAG STF 166—posted the highest Winstone 96 scores of their respective CPU classes. Seagate's Fast/Wide SCSI-2 hard disks (the ST32550W in the 150-MHz PC and the ST15150W in the 166-MHz PC) and a Number Nine Imagine 128 graphics card along with 512K of L2 cache proved a winning combination for this duo.

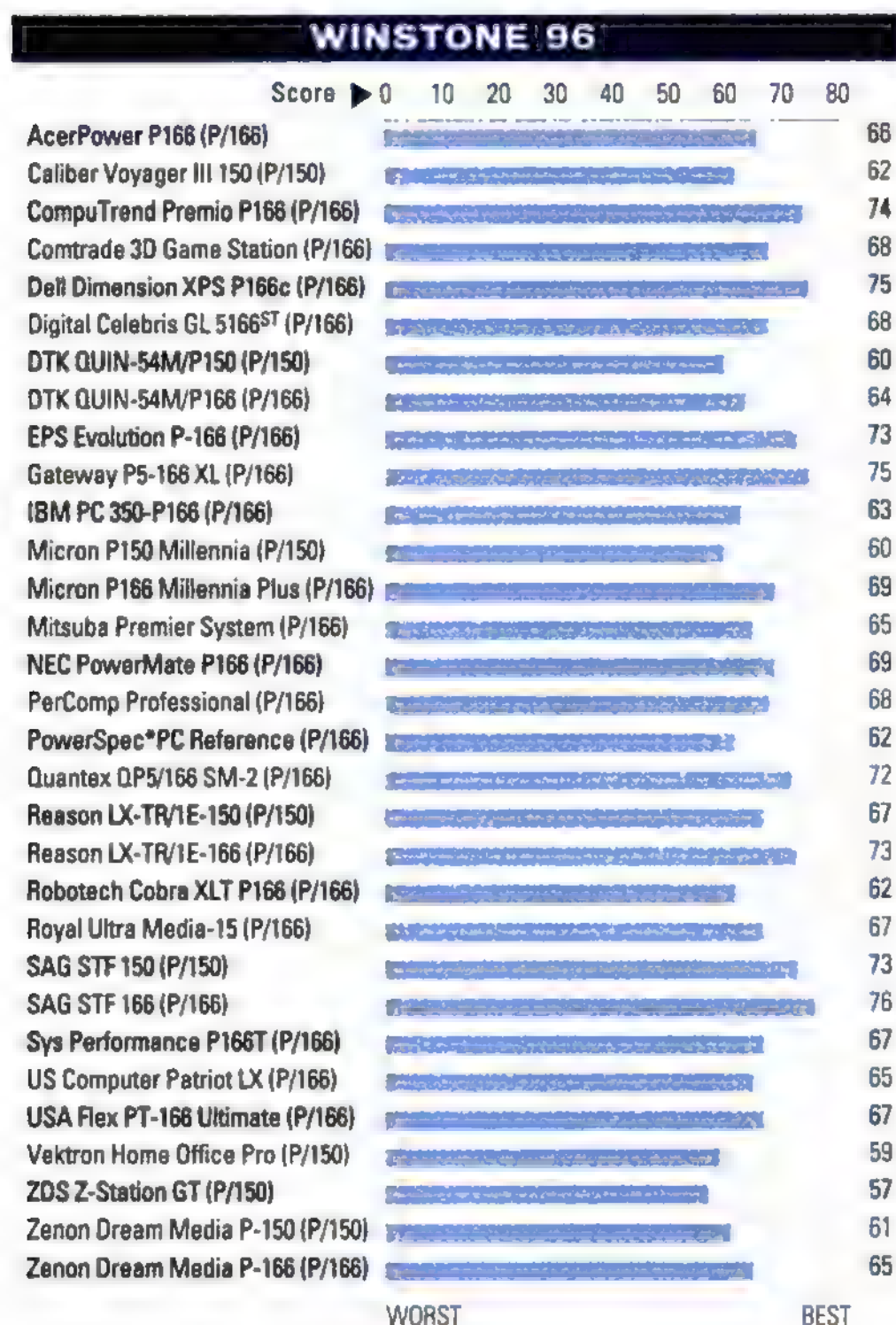
Sys Technology configured its Sys Performance P166T with two 1.2GB hard disks and requested that we conduct testing of the unit in a manner quite different from *PC Magazine's* normal testing scenario. Sys asked that we leave Windows 95 and its swap file on the first hard disk and install the Winstone working directory on the second disk. With this setup, swap-file accesses can proceed independently of Winstone data accesses, and a small performance boost is realized. Our testing showed an increase of just under 3 percent (which is within Winstone's margin of error) from the single-disk numbers we report in our Winstone test charts. The performance increase attained by using two disks is not, in our opinion, a very significant improvement. Also, to keep testing on a fair plane, we set up our tests to run from one hard disk regardless of how many were installed in a system.

GRAPHICS AND DISK WINMARK 96 TESTS

Systems using the Number Nine Imagine 128 graphics card garnered the best Graphics WinMark 96 scores. The SAG STF 150, Dell Dimension XPS P166c, SAG STF 166, and the CompuTrend Premio Triton P166 all rode the power of this card to top scores. This card's newest driver has shown better performance than the driver bundled with Windows 95.

For the first time, we saw 3-D games/graphics boards. The Comtrade 3D Game Station 8X came with the Diamond Edge 3D 3240 card with the Nvidia NV1 chip set (which uses VRAM); the PowerSpec*PC Reference Series P166 came with the Diamond Edge 3D 2120 with an SGS-Thomson STG 2000 chip set (which uses DRAM). Though these systems are sold as game machines, they didn't live up to our expectations on our graphics tests: Their Graphics WinMark 96 scores were about 10 percent less than the average and almost 30 percent less than the top-scoring PCs.

On our Disk WinMark tests, machines with the fastest-spinning drives typically produce the highest scores. The three fastest-spinning SCSI drives in this roundup—the Seagate ST15150W, the Seagate ST32550W and the Quantum Grand Prix XP32151S—all have rotational speeds of 7,200 rpm. The two Seagate-equipped SAG machines took top honors on our Disk WinMark tests. On the Enhanced IDE



side of the house, rotational speeds are reaching 5,200 or 5,400 rpm. The perennial IDE champ, the Quantum Fireball, now faces much stiffer competition than in the past. Although the Fireball 1080A and 1280A still perform best, their lead is narrowing as faster-spinning drives enter the market.

CPUMARK₁₆ & CPUMARK₃₂ TESTS

Asynchronous L2 cache, once the most common type (due to its lower price), disappeared in this review: All L2 cache was either synchronous or pipelined-burst synchronous, both of which allow faster cache-burst timings than asynchronous cache. Here, those with the most cache garnered the higher scores: The top seven Pentium/166 and top two Pentium/150 PCs came with 512K of L2 cache instead of the more common 256K. This extra cache adds only about 7 percent to the CPUmark₁₆ score for a cost of around \$100.

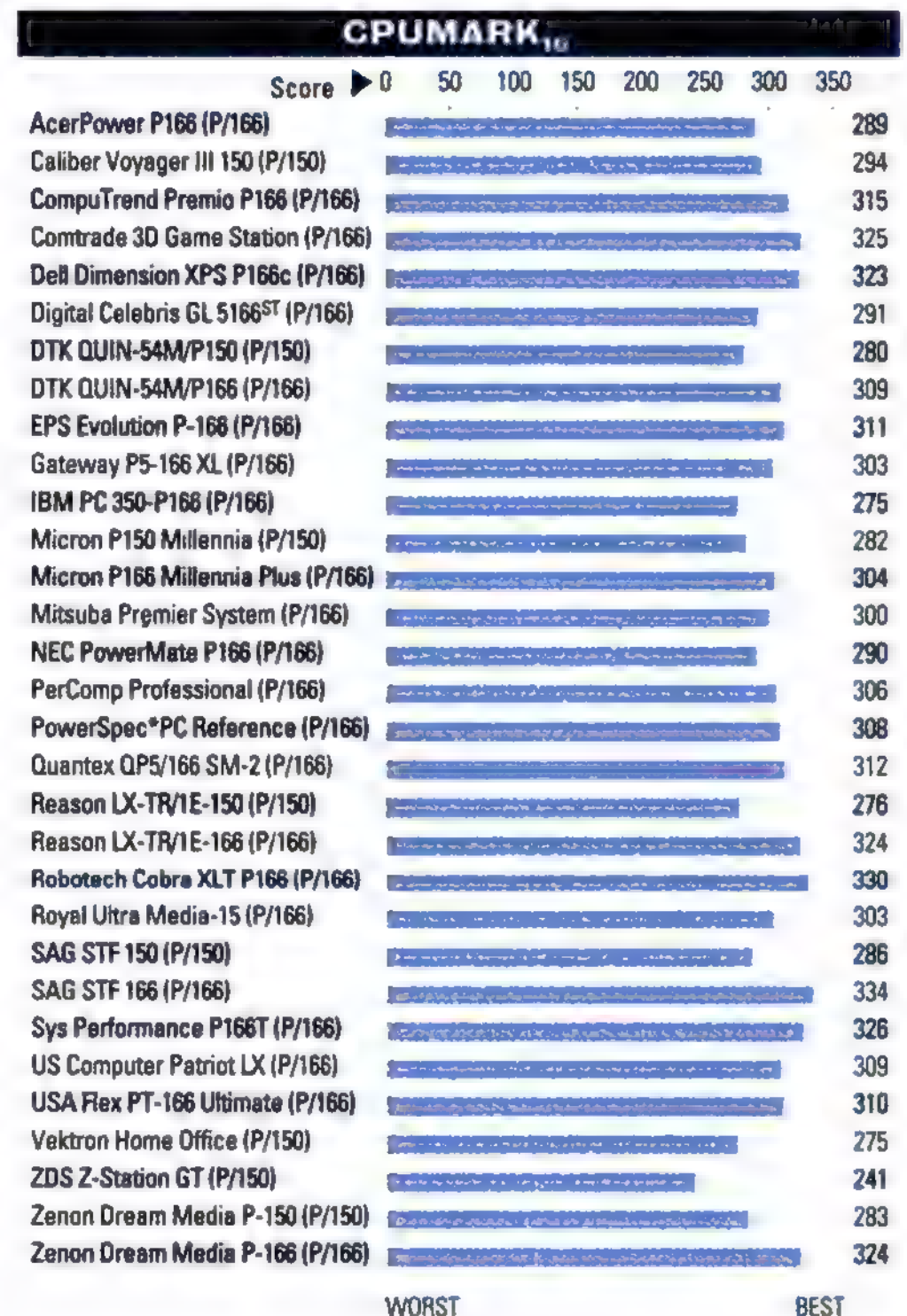
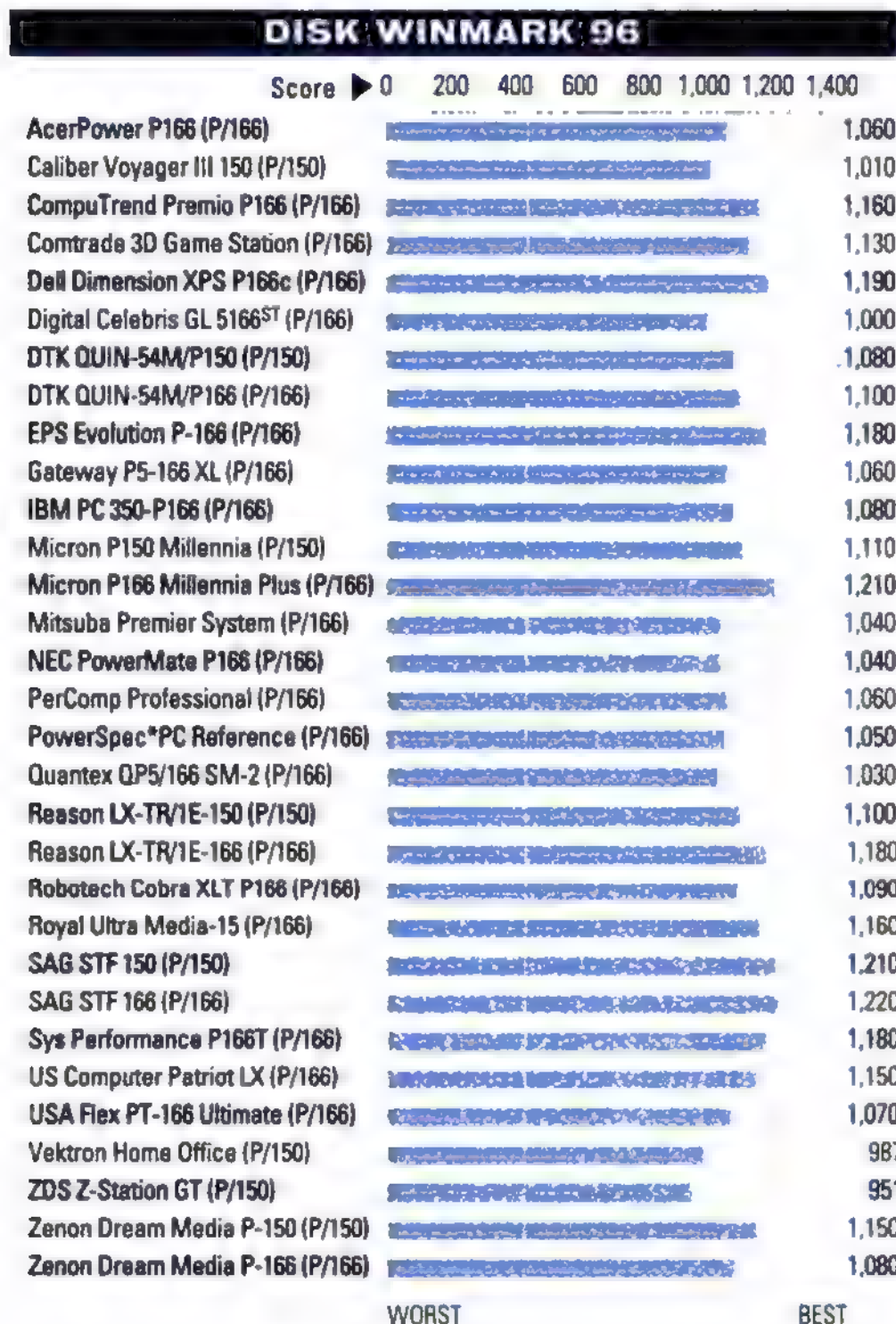
CD-ROM TESTS

The TEAC CD-56E 6X CD-ROM drive was a consistent winner. Its low average access time and 6X speed translated into high CD-ROM WinMark 96 scores for systems that used it. The Aztech CDA 668-01I 6X drive used by the Royal Computers Ultra Media-15 and the PowerSpec*PC Reference Series P166 was a disappointment. The Aztech's measured average access time of over 300 ms was extremely slow.

Although it is a 6X drive, it recorded sequential read (throughput) times more in line with a 4X drive, and the CD-ROM WinMark 96 scores garnered by the Royal and PowerSpec units were lower than those of most PCs using 4X drives. Our first look at the Diamond 8X drive used by the Comtrade PC was also not positive. Although it was able to show a 1,200-Kbps throughput on our sequential read test, its slow access time gave it a CD-ROM WinMark score lower than most other drives.

MULTIMEDIA TESTS

For today's average video clips—commonly authored at no better than 320-by-240, 300 KBps—all of these PCs proved sufficient. We observed differences when we pushed the video subsystem by playing a clip that stretches a 160-by-120 clip to full-screen. The two systems using the Diamond Edge graphics card, one from Comtrade and the other from PowerSpec, did not perform up to expectations. While the Nvidia chip has built-in *x* and *y* interpolation as well as color-space conversion, it dropped over 200 frames on our scaling test. We suspect that the drivers are at fault. When we first tested the units with the Diamond Edge cards, they would not run any of our tests. New drivers from Diamond enabled them to complete our tests, but we believe the scaling aspect of the driver needs further tuning.—*Analysis written by Richard Fisco*



CPUMARK₃₂

Score	0	50	100	150	200	250	300	350
AcerPower P166 (P/166)								289
Caliber Voyager III 150 (P/150)								298
CompuTrend Premio P166 (P/166)								304
Comtrade 3D Game Station (P/166)								330
Dell Dimension XPS P166c (P/166)								330
Digital Celebris GL 5166 ST (P/166)								281
DTK QUIN-54M/P150 (P/150)								280
DTK QUIN-54M/P166 (P/166)								309
EPS Evolution P-166 (P/166)								310
Gateway P5-166 XL (P/166)								300
IBM PC 350-P166 (P/166)								266
Micron P150 Millennia (P/150)								278
Micron P166 Millennia Plus (P/166)								313
Mitsuba Premier System (P/166)								301
NEC PowerMate P166 (P/166)								275
PerComp Professional (P/166)								309
PowerSpec [®] PC Reference (P/166)								307
Quantex QP5/166 SM-2 (P/166)								310
Reason LX-TR/1E-150 (P/150)								274
Reason LX-TR/1E-166 (P/166)								328
Robotech Cobra XLT P166 (P/166)								335
Royal Ultra Media-15 (P/166)								299
SAG STF 150 (P/150)								291
SAG STF 166 (P/166)								339
Sys Performance P166T (P/166)								333
US Computer Patriot LX (P/166)								309
USA Flex PT-166 Ultimate (P/166)								303
Vektron Home Office Pro (P/150)								275
ZDS Z-Station GT (P/150)								231
Zenon Dream Media P-150 (P/150)								277
Zenon Dream Media P-166 (P/166)								332

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How We Tested

We tested all systems with 1GB hard disks or larger, 4X CD-ROM drives or faster, 16-bit sound boards, and 16MB of RAM. We used each vendor's preinstalled graphics driver for 1,024-by-768 resolution with 256 colors, small fonts, and a refresh rate of 75 Hz. We also disabled power management features and removed unnecessary drivers. We defragmented hard disks before each test and let Windows 95 manage virtual memory settings.

We used our benchmark test suite **Winstone 96, Version 1.0**, to measure the units' performance when running typical Windows applications. Winstone 96 measures the time a PC takes to execute a set of scripts that utilize 13 best-selling Windows applications. Winstone weights a given PC's test timings based on the applications' unit market shares; it derives a composite number and converts it to a relative score. (The score is relative to the performance of a 486SX/25 Dell 425s/P with 8MB of RAM, whose score is defined as 10.) We also present separate Winstone 96 scores for four categories of applications: spreadsheet, word processing, database, and business graphics/DTP. Each of these scores is relative to the Dell 425s/P, whose score is defined as 1.

We used our benchmark test suite, **WinBench 96, Version 1.0**, as a measure of graphics, disk, processor, CD-ROM, and motion-video performance under Windows. The **Graphics WinMark 96** score, a number based on 115 tests of Windows GDI functions, represents performance of each machine's graphics subsystem under Windows. The **Disk WinMark 96** score, based on extensive application profiling, represents the disk subsystem's performance under Windows. The **CPUMark₁₆** and **CPUMark₃₂** scores indicate the speed

CD-ROM WINMARK 96

Score	0	100	200	300	400	500	600	700
AcerPower P166 (P/166)								314
Caliber Voyager III 150 (P/150)								446
CompuTrend Premio P166 (P/166)								581
Comtrade 3D Game Station (P/166)								447
Dell Dimension XPS P166c (P/166)								611
Digital Celebris GL 5166 ST (P/166)								438
DTK QUIN-54M/P150 (P/150)								508
DTK QUIN-54M/P166 (P/166)								524
EPS Evolution P-166 (P/166)								585
Gateway P5-166 XL (P/166)								421
IBM PC 350-P166 (P/166)								574
Micron P150 Millennia (P/150)								577
Micron P166 Millennia Plus (P/166)								602
Mitsuba Premier System (P/166)								455
NEC PowerMate P166 (P/166)								605
PerComp Professional (P/166)								597
PowerSpec [®] PC Reference (P/166)								375
Quantex QP5/166 SM-2 (P/166)								406
Reason LX-TR/1E-150 (P/150)								603
Reason LX-TR/1E-166 (P/166)								586
Robotech Cobra XLT P166 (P/166)								588
Royal Ultra Media-15 (P/166)								389
SAG STF 150 (P/150)								390
SAG STF 166 (P/166)								395
Sys Performance P166T (P/166)								558
US Computer Patriot LX (P/166)								601
USA Flex PT-166 Ultimate (P/166)								435
Vektron Home Office Pro (P/150)								494
ZDS Z-Station GT (P/150)								377
Zenon Dream Media P-150 (P/150)								458
Zenon Dream Media P-166 (P/166)								463

WORST

BEST

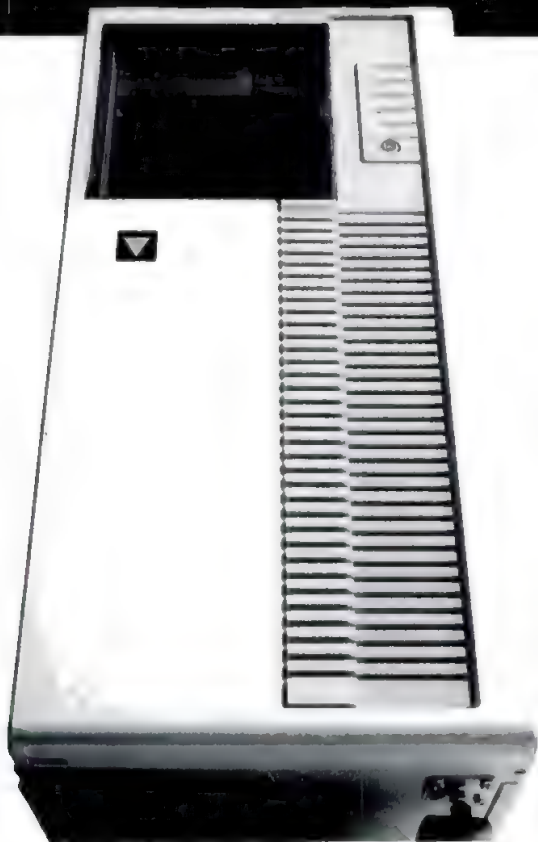
of a PC's processor subsystem under 16- and 32-bit Windows operating systems, respectively. WinBench 96 bases these scores on large instruction mixes that emulate the CPU activity of real-world applications.

The **CD-ROM WinMark 96** tests gauge the performances of the machines' CD-ROM subsystems, which includes the CD-ROM drive, its adapter, and its required software drivers. This test is based on a profile of six of today's most popular Windows CD-ROMs.

We report the results of the **CD-ROM Sequential 16K Read** test, which measures the throughput of the CD-ROM subsystem as it reads 16K blocks of data on a CD-ROM. The **Access Time** score measures the CD-ROM drive's performance while it is randomly accessing 2K files from the entire CD-ROM.

The **CD-ROM CPU Utilization** score represents the percentage of the processor's bandwidth occupied by servicing the CD-ROM subsystem while it retrieves data. To determine the utilization, WinBench 96 uses a default block size of 16K. The transfer rate defaults to the maximum rate of your particular CD-ROM subsystem. WinBench 96 then calculates this transfer rate before it runs the actual test. WinBench 96 also includes **Video Test**, a suite of 33 video clips that measure the PC's ability to play full-motion AVI video files. Video Test allows you to test video-playback performance with two types of clips at a variety of data and frame rates, using either the Indeo or Cinepak codec.

We report results from the **High-Quality Action Indeo** test, which uses an Action Indeo, 320-by-240, 30-frame-per-second, 600-KBps video clip; the **Full-Screen Video Scaling** test, which uses an Action Indeo, 160-by-120, 30-fps, 300-KBps clip; and the **Medium-Quality Action Cinepak** test, which uses an Action Cinepak 320-by-240, 30-fps, 300-KBps clip.



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Pentium/150 systems													
Caliber Voyager III 150	5.7	6.3	6.6	6.5	613	203	39%	0	65%	0	72%	0	51%
DTK QUIN-54M/P150	5.5	6.1	6.3	6.3	918	227	50%	0	65%	0	70%	0	45%
Micron P150 Millennia	5.5	6.2	6.3	6.3	918	205	51%	0	64%	0	73%	0	45%
Reason Square 5 LX-TR/1E-150	6.1	6.7	7.2	7.0	918	192	33%	0	51%	0	71%	0	37%
SAG STF 150	6.8	7.3	7.9	7.3	613	206	21%	0	54%	0	64%	0	40%
Vektron Home Office Pro-P150	5.4	6.0	6.2	6.2	876	213	42%	0	59%	0	67%	0	43%
ZDS Z-Station GT	5.3	5.9	5.9	6.0	611	308	63%	56	98%	312	100%	2	80%
Zenon Dream Media P-150	5.6	6.2	6.6	6.5	611	204	41%	0	69%	0	72%	0	47%
Pentium/166 systems													
AcerPower P166	6.0	6.8	6.8	6.8	611	340	38%	0	67%	54	99%	0	46%
CompuTrend Premio Triton P166	7.0	7.4	7.8	7.5	918	207	47%	0	64%	0	63%	2	43%
Comtrade 3D Game Station 8X	6.3	7.0	7.0	6.9	1,200	250	67%	0	61%	207	100%	0	43%
Dell Dimension XPS P166c	7.1	7.6	7.8	7.6	919	193	30%	0	54%	0	61%	0	41%
Digital Celebris GL 5166 ST	6.6	6.9	6.9	7.0	614	189	62%	0	87%	0	86%	0	64%
DTK QUIN-54M/P166	5.8	6.5	6.7	6.8	918	225	46%	0	60%	0	66%	0	44%
EPS Evolution P-166	6.9	7.4	7.7	7.4	918	210	47%	8	66%	8	66%	3	43%
Gateway P5-166 XL	7.0	7.6	7.9	7.4	603	256	39%	0	63%	0	76%	0	50%
IBM PC 350-P166	6.1	6.4	6.1	6.5	919	182	31%	0	59%	0	67%	0	44%
Micron P166 Millennia Plus	6.4	7.1	7.2	7.0	911	163	47%	0	58%	0	64%	0	42%
Mitsuba Premier System 166	5.9	6.5	6.8	7.1	613	200	20%	0	53%	0	61%	0	38%
NEC PowerMate P166	6.5	7.2	7.1	6.8	919	181	47%	0	68%	0	67%	0	45%
PerComp P166 Professional	6.2	7.1	7.1	6.8	919	172	46%	3	62%	8	65%	0	44%
PowerSpec [®] PC Reference Series P166	5.8	6.4	6.2	6.6	693	322	39%	0	67%	288	100%	0	47%
Quantex QP5/166 SM-2	6.9	7.3	7.3	7.2	692	256	34%	0	64%	0	71%	0	42%
Reason Square 5 LX-TR/1E-166	6.9	7.3	7.7	7.5	918	210	29%	0	47%	0	56%	0	35%
Robotech Cobra XLT P166	5.7	6.3	6.5	6.6	918	205	47%	0	54%	0	60%	0	40%
Royal Ultra Media-15	6.4	6.8	6.6	7.0	610	357	35%	0	66%	0	67%	0	45%
SAG STF 166	7.1	7.9	8.2	7.4	613	199	21%	0	53%	0	61%	0	40%
Sys Performance P166T	6.1	6.7	7.3	7.1	917	209	50%	0	59%	0	65%	0	44%
US Computer Patriot LX 166	5.8	6.7	7.0	6.6	918	187	40%	0	57%	0	64%	0	42%
USA Flex PT-166 Ultimate Multimedia Tower	6.1	7.2	7.0	6.8	898	205	40%	3	60%	0	68%	0	46%
Zenon Dream Media P-166	6.0	6.5	7.0	6.9	613	216	39%	0	63%	0	67%	0	45%

1 With an Action, Indeo, 320 x 240, 30-fps, 600-KBps clip.

2 With an Action, Indeo, 160 x 120, 30-fps, 300-KBps clip scaled to full screen (1,024 x 768).

3 With an Action, Cinepak, 320 x 240, 30-fps, 300-KBps clip.

CompuTrend Systems Inc.

Premio Triton P166

CompuTrend Systems' Premio Triton P166 (\$3,399 street) offers top components such as a 1GB Quantum Fireball hard disk, 256K of pipelined-burst cache, a 17-inch monitor, and a Number Nine Imagine 128 graphics card with 4MB of VRAM. Moreover, it integrates them well, with strong performance as the result. This system is aimed at the corporate market and is meant to serve as a general-purpose PC or graphics workstation. Along with the Premio Triton series, CompuTrend also markets the Premio line of value-oriented Pentium systems. CompuTrend sells its systems through resellers and has a direct-sales subsidiary called Premio Express.

This Pentium/166-based desktop system was equipped with a 6X CD-ROM drive, a

16-bit sound card with FM and wavetable synthesis, and a pair of Jazz J-590AV speakers. The Triton P166 also came bundled with Novell's PerfectOffice 3.0.

The Triton P166 performed very well on our benchmark tests. With its Imagine 128-based graphics card, it garnered above-average Graphics WinMark 96 and CD-ROM WinMark 96 scores for its class. Its Winstone 96 and Disk WinMark 96 scores were average, and the unit encountered no problems on our video-playback tests.

The company offers a two-year parts-and-labor warranty with this system. Four years of on-site service is an additional \$229.—AY

Premio Triton P166. Street price: \$3,399. CompuTrend Systems Inc., City of Industry, CA; 800-677-6477, 818-333-5121; fax, 818-369-6803; <http://www.premiopc.com>. Circle 458 on reader service card.

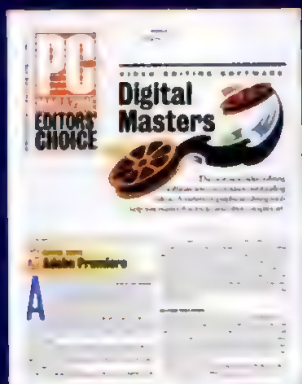
Comtrade

3D Game Station 8X

Priced attractively at \$3,375 (street), Comtrade's 3D Game Station 8X is a good home-office/entertainment system. It's not only a solid performer with a generous software bundle; it also packs components that will help you take full advantage of your PC, such as 512K of L2 cache and a specialized graphics card. The system's 8X Diamond CD-ROM drive, however, was a disappointing performer. Comtrade also markets the Artists Dream Machine line, geared toward intensive desktop publishing or graphics use.

As its name implies, this Pentium/166-based system is designed for play. Toward that end, Comtrade has included a joystick (\$25, included in above price), as well as an adapter card that allows you to

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plug in SEGA's Saturn Pad. To help you enjoy the SEGA hardware, Comtrade has included Virtual Fighter and NASCAR Racing CDs. Novell's PerfectOffice 3.0 and the Microsoft Family Pack were also bundled.

The unit's graphics card, a Diamond Edge 3D 3240, features an integrated sound chip, as well as the Nvidia NV1 chip set, which is specifically geared for games and aids some video processes. The audio gear includes a 16-bit Diamond Edge 3D 3240 sound card and a set of Premier speakers. Storage is handled by a 1.2GB Quantum Fireball 1280A hard disk. A 28.8-/14.4-Kbps data/fax modem and a 17-inch MAG InnoVision monitor were also included.

The 3D Game Station 8X scored within the average range on our Winstone 96, Graphics WinMark 96, and Disk WinMark 96 tests. Surprisingly, the unit's 8X CD-ROM drive did not make for a stellar CD-ROM WinMark 96 score: In fact, the unit posted a below-average score, because of the drive's slow access time. The system had some trouble scaling on our full-screen, high-quality video tests.

Comtrade backs up this product with a one-year parts-and-labor warranty. On-site service is an additional \$25 for one year.—AY

3D Game Station 8X. Street price: \$3,375. Comtrade, City of Industry, CA; 800-969-2123, 818-961-6688; fax, 818-369-1479. Circle 459 on reader service card.



DTK QUIN-54M/P166, EPS Evolution P-166.

Dell Computer Corp.

Dimension XPS P166c

Dell Computer Corp. designed the Dimension XPS P166c (\$3,899 street) for the small-office/home-office market and for experienced users. The Pentium/166-based mini-tower should serve its targets well: It was an average to above-average performer on all our benchmark tests. In addition to the Dimension XPS line, Dell also offers the Dimension line, which is targeted at the entry-level market, and the OptiPlex line for large businesses. (A 133-MHz Dimension XPS was an Editors' Choice in our roundup of December 5, 1995.)

The XPS P166c came with a larger-

than-average amount of external cache—512K (most units had 256K)—and 16MB of EDO DRAM, which helped it achieve an above-average Winstone 96 score. Its Disk WinMark 96 score was average, thanks to a 1GB Quantum Fireball hard disk. A Number Nine Imagine 128 graphics card with 4MB of VRAM was instrumental in the system's above-average Graphics WinMark 96 score.

A TEAC 6X CD-ROM drive, a set of Altec Lansing speakers, and a Creative Labs sound card complete Dell's offering.

Dell offers a three-year-parts, one-year-labor warranty, with one year of on-site service. Dell also offers 24-hour, 7-day, toll-free technical support.—Mary E. Behr

Dimension XPS P166c. Street price: \$3,899. Dell Computer Corp., Austin, TX; 800-613-3355, 512-338-4400; fax, 800-727-8320; <http://www.dell.com>. Circle 446 on reader service card.

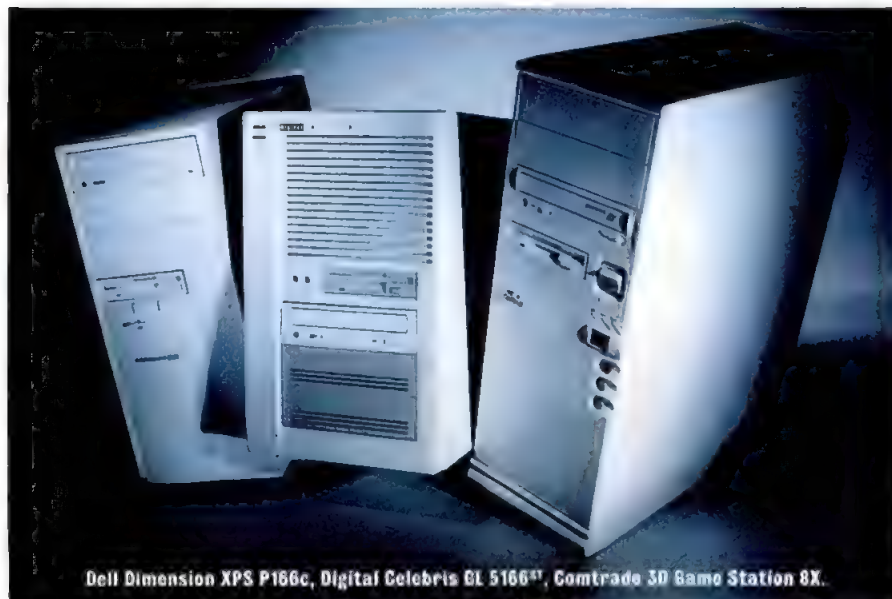
Digital Equipment Corp.

Celebris GL 5166ST

When it comes to designing interesting PCs, Digital Equipment Corp. rarely takes a back seat to anyone, and its \$5,218 (street) Celebris GL 5166ST is no exception. Powered by a Pentium/166 CPU, the unit is packed with business-friendly features such as built-in networking and DMI support. Its performance does not disappoint either: The unit's benchmark scores were consistently within the average range.

The network-ready Celebris GL 5166ST is meant for Windows 95 power users, but clear documentation and online help make it easy for novices to get up to speed. Digital also sells the Celebris XL line of midrange workstations and the Venturis line of entry-level business systems.

The Celebris GL 5166ST is a short-tower system packed with components, including a 1.5GB hard disk, built-in SCSI-2 support, and a quad-speed CD-ROM drive. It also included a 17-inch monitor and a set of Labtec speakers (the



Dell Dimension XPS P166c, Digital Celebris GL 5166ST, Comtrade 3D Game Station 8X.

vendor also sells JBL speakers).

All essential functions are integrated on the motherboard, which is centered around components like EDO DRAM and 256K of pipelined-burst secondary processor cache. The motherboard also offers a Matrox 2064W graphics chip set with 2MB of WRAM, a 16-bit FM synthesis audio chip set, and 10-Mbps Ethernet support.

The system posted average scores on our Winstone 96 and Graphics WinMark 96 tests but turned in the lowest Disk WinMark 96 score in its CPU class. The culprit was its relatively slow 4,000-rpm hard disk. Also, because it had one of the few quad-speed CD-ROM drives in this roundup, it posted a below-average CD-ROM WinMark 96 test score. The system handled full-motion videos adequately, with only minor jerkiness at the start of some full-screen samples.

The unit's three-year warranty includes one year of free on-site service. Digital also offers 24-hour, 7-day, toll-free technical support.—*Robert S. Anthony*
Celebris GL 5166ST. Street price: \$5,218. Digital Equipment Corp., Maynard, MA; 800-216-8115, 508-493-5111; fax, 800-388-3228; <http://www.pc.digital.com>. *Circle 447 on reader service card.*

DTK Computer Inc.

QUIN-54M/P150, QUIN-54M/P166

Competitively priced on the street at \$3,449 and \$3,849 respectively, the Pentium/150-based QUIN-54M/P150 and Pentium/166-based QUIN-54M/P166 from DTK Computer Corp. performed on a par with other systems in their processor classes. The DTK machines also features rail-mounted drive cages for easy servicing and large 2.1GB hard disks. DTK distributes these units through resellers as well as direct to corporate and government accounts.

These PCs are identically outfitted; each comes with 256K of pipelined-burst L2 cache and 16MB of EDO DRAM. Storage in each is handled by a 2.1GB hard disk.

A Diamond Stealth64 Video 3240 graphics accelerator card with the S3 Vision968 chip set and 2MB of VRAM

helped each unit garner an average Graphics WinMark 96 score within its respective CPU group. The units' Winstone 96 and Disk WinMark 96 scores were also average for their CPU classes.

Sound is provided by a Creative Labs Sound Blaster card capable of FM and wavetable synthesis. A TEAC 6X CD-ROM drive and Sound Beat speakers are included to meet your multimedia needs.

DTK backs up each of these machines with a two-year warranty. On-site service costs \$50 for one year.—*MEB*

QUIN-54M/P150. Street price: \$3,449. **QUIN-54M/P166.** Street price: \$3,849. DTK Computer Inc., City of Industry, CA; 800-289-2385, 908-562-8800; fax, 818-810-0090. *Circle 462 on reader service card.*

EPS Technologies Inc.

Evolution P-166

The Evolution P-166 from EPS Technologies performed competitively on our benchmark tests and offers some excellent extras, including Labtec 3D Spatializer-Sound speakers and a Turtle Beach Monte Carlo sound card with

with Microsoft Windows) graphics memory types are faster than DRAM because both are dual-ported, and therefore can move data in and out simultaneously

Screen diagonal claimed/measured (inches)

The claimed display size represents the vendor's claimed size of the monitor. The actual viewing area is the diagonal measurement of the screen itself. In many cases, the measured viewing area is smaller than the claimed diagonal size.

CD-ROM drive interface ATAPI is a specification that enables CD-ROM drives to act much like hard disks, which allows them to be connected to Enhanced IDE interfaces. Proprietary drives connect to a special connector on a sound board

Expansion-bus slots PCI cards may share a backplane with ISA cards, meaning that you can use one or the other but not both simultaneously. These shared slots are listed as PCI/ISA

FM and wavetable synthesis support. And the system's street price of \$2,795 reflects the company's claim that the Evolution is marketed as a value-priced, all-purpose system.

This system posted an average Winstone 96 score and an above-average CD-ROM WinMark 96 score within its processor class. Disk WinMark 96 and Graphics WinMark 96 scores were both average.

The mini-tower system posted these scores as a result of some well-chosen components, including a 1.2GB Quantum Fireball hard disk, a 6X CD-ROM drive, 256K of pipelined-burst secondary processor cache, and a Number Nine Motion 771 graphics card (based on the S3 Vision968 chip set) with 2MB of VRAM. This machine also included a 28.8-/14.4-Kbps data/fax modem.

The Evolution P-166 comes with a three-year-parts, one-year-labor warranty, which includes one year of on-site service.—*AY*

Evolution P-166. Street price: \$2,795. EPS Technologies Inc., Jefferson, SD; 800-447-0921, 605-966-5586; fax, 605-966-5482; epstech@ix.netcom.com. *Circle 464 on reader service card.*

SUMMARY OF FEATURES

150- and 166-MHz Pentium PCs

Price For machines sold through resellers, assume that street prices will be 15 to 20 percent lower than list prices. Some companies factor this discount into their quoted prices; in such cases, we indicate that the cited price is a street price.

Processor Numeric suffixes to the Pentium name indicate clock speeds in megahertz.

Installed RAM Some PCs use EDO (extended data out) DRAM, which can marginally boost performance over standard fast-page mode DRAM

Hard disk interface EIDE denotes Enhanced IDE, an extension to IDE that supports faster transfer rates, higher disk capacities, and mass-storage devices other than hard disks. Fast ATA-2 denotes Seagate's EIDE-like specification for increased transfer rates and larger capacities

Graphics adapter (and memory type) VRAM and the new WRAM (Window RAM—not associated

SUMMARY OF FEATURES

150- and 166-MHz Pentium PCs

■ YES ■ NO

In alphabetical order by company

	AcerPower P166	Caliber Voyager III 150	CompuTrend Premio Triton P166	Comtrade 3D Game Station 8X	Dell Dimension XPS P166c	Digital Celebris GL 5166ST	DTK QUIN- 54M/P150	DTK QUIN- 54M/P166
Price of tested configuration	\$3,895 (street)	\$3,899 (street)	\$3,399 (street)	\$3,375 (street)	\$3,899 (street)	\$5,218 (street)	\$3,449 (street)	\$3,849 (street)
Processor	Pentium/166	Pentium/150	Pentium/166	Pentium/166	Pentium/166	Pentium/166	Pentium/150	Pentium/166
Installed RAM	16MB	16MB EDO	16MB EDO	16MB EDO	16MB EDO	16MB EDO	16MB EDO	16MB EDO
Hard disk manufacturer and model	Western Digital Caviar AC31600	Seagate ST32430W	Quantum Fireball 1080A	Quantum Fireball 1280A	Quantum Fireball 1080A	Western Digital Caviar AC31600	Seagate ST32140A	Seagate ST32140A
Capacity and interface	1.5GB EIDE	2GB Fast/Wide SCSI-2	1GB Fast ATA-2	1.2GB Fast ATA-2	1GB Fast ATA-2	1.5GB EIDE	2.1GB Fast ATA-2	2.1GB Fast ATA-2
Monitor manufacturer and model	Acer 7176/72	Sceptre CC- 615GL	Sceptre Q766DU	MAG InnoVision DX-17F	Dell D1726S-HS	Digital PCXBV-KA	Tatung CM15VDS	ADI MicroScan 5EP
Screen diagonal claimed/measured (inches)	17, 16	15, 14	17, 16	17, 16	17, 15.5	17, 16	15, 13.5	17, 15.5
Graphics adapter	Diamond Stealth64 Video 3240	Diamond Stealth64 Video 3240	Number Nine Imagine 128	Diamond Edge 3D 3240	Number Nine Imagine 128	Matrox MGA Millennium	Diamond Stealth64 Video 3240	Diamond Stealth64 Video 3240
Memory	2MB VRAM	2MB VRAM	4MB VRAM	2MB VRAM	4MB VRAM	2MB VRAM	2MB VRAM	2MB VRAM
CD-ROM drive	Mitsumi CRMC-FX400D	Plextor PX-4XCS	TEAC CD-56E	Diamond 8422-IDE	TEAC CD-56E	Toshiba XM-530TA	TEAC CD-56E	TEAC CD-56E
Drive speed and interface	4X ATAPI	4X SCSI	6X ATAPI	8X ATAPI	6X ATAPI	4X ATAPI	6X ATAPI	6X ATAPI
Sound adapter	Creative Labs Sound Blaster 16	Creative Labs Sound Blaster 16	Behavior Tech 1831	Diamond Edge 3D 3240	Creative Labs Sound Blaster AWE32 Value Ed	ESS 1688	Creative Labs Sound Blaster 16	Creative Labs Sound Blaster 16
Interface	ISA card	ISA card	ISA card	PCI card	ISA card	Motherboard	ISA card	ISA card
Speakers	Yamaha YST-M10	MIDI Land MLI 691H	Jazz J-590AV	Premier SP-115	Altec Lansing ACS31	Labtec LCS-800	Sound Beat CP-55	Sound Beat CP-55
Modem manufacturer and model	None	None	None	Powercom WS-2814I	None	None	None	None
Speed (data/fax)	N/A	N/A	N/A	28.8/14.4 Kbps	N/A	N/A	N/A	N/A
Motherboard Components								
Installed external RAM cache and type	256K pipelined-burst	512K pipelined-burst	256K pipelined-burst	512K pipelined-burst	512K synchronous	256K pipelined-burst	256K pipelined-burst	256K pipelined-burst
Motherboard manufacturer	Acer	ASUSTek	CompuTrend	Tyan	Dell	Digital	DTK	DTK
Chip set manufacturer and model	Intel Triton	Intel Triton	Intel Triton	Intel Triton	Intel Triton	Intel Triton	Intel Triton	Intel Triton
BIOS manufacturer and version (or date)	Acer R01-N5	Award 4.50PG	Award 4.50PG	Award 4.50PG	AMI/Dell X22	Phoenix (7/25/95)	Award 4.50PG	Award 4.50PG
Expandability								
Maximum RAM	128MB	128MB	128MB	128MB	128MB	128MB	128MB	128MB
Expansion-bus slots	4 ISA, 4 PCI, 1 PCI/ISA	2 ISA, 2 PCI, 1 PCI/ISA	3 ISA, 3 PCI, 1 PCI/ISA	4 ISA, 3 PCI, 1 PCI/ISA	3 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 2 PCI/ISA	4 ISA, 2 PCI, 1 PCI/ISA	4 ISA, 2 PCI, 1 PCI/ISA
Accessible drive bays (5.25", 3.5")	3, 2	4, 1	3, 2	3, 2	3, 1	3, 1	4, 1	4, 1
Internal drive bays (5.25", 3.5")	0, 2	0, 2	0, 1	0, 3	0, 2	0, 2	0, 4	0, 3
Power-supply wattage	240W	230W	200W	210W	230W	200W	250W	250W
Parallel, serial, mouse ports	1, 2, 1	1, 2, 1	1, 2, 1	1, 2, 0	1, 2, 1	1, 2, 1	1, 2, 0	1, 2, 0
Service and Support								
7-day, 24-hour live technical support	■	■	■	■	■	■	■	■
Standard warranty on parts/labor	3 years/1 year	2 years/1 year	2 years/2 years	1 year/1 year	3 years/1 year	3 years/3 years	2 years/2 years	2 years/2 years
On-site service charge (first year)	Included	Included	\$229 (4 years)	\$25	Included	Included	\$50	\$50

N/A—Not applicable: The product does not have this feature

Gateway 2000 Inc.

Gateway P5-166 XL



The Editors' Choice-winning Pentium/166-based Gateway P5-166 XL is a multimedia powerhouse that can immerse you in your favorite games and still satisfy your business needs. The P5-166 XL (\$3,789 street) offers solid performance and a great selection of hardware

and software. Gateway also sells the midrange Best Buy series and the entry-level Family PC series for the small-office/home-office market.

Ready for serious sight and sound? We were blown away by this mini-tower's Ensoniq wavetable sound card combined with Altec Lansing ACS400 Surround Sound speakers and a powered subwoofer. Also included were a 17-inch monitor, a 6X CD-ROM drive, and an internal U.S. Robotics Sportster 28.8 Vi

DSVD data/fax/voice modem. Gateway will bundle either Microsoft Office 95 Professional Edition and Gateway Generations II Consumer Edition (for business systems) or an eight-CD bundle featuring 45 titles, including Microsoft Encarta 96 and Music Central 96 (for home systems).

The P5-166 XL was an above-average performer on our Winstone 96 tests, and it earned an average score on our Disk WinMark 96 tests. The Matrox MGA Millennium PCI graphics accelerator with 4MB

COVER STORY
150- and 166-MHz Pentium PCs

Continues



EPS Evolution P-166	Gateway P5-166 XL	IBM PC 350-P166	Micron P150 Millennium	Micron P166 Millennium Plus	Mitsuba Premier System 166	NEC PowerMate P166	PerComp P166 Professional	PowerSpec*PC Reference Series P166	Quantex QP5/166 SM-2
\$2,795 (street)	\$3,789 (street)	\$4,400 (street)	\$3,047 (list)	\$4,446 (list)	\$3,900 (street)	\$4,169 (street)	\$3,449 (street)	\$3,878 (street)	\$3,299 (street)
Pentium/166	Pentium/166	Pentium/166	Pentium/150	Pentium/166	Pentium/166	Pentium/166	Pentium/166	Pentium/166	Pentium/166
16MB EDO	16MB EDO	16MB EDO	16MB EDO	16MB EDO	16MB EDO	16MB EDO	16MB EDO	16MB EDO	16MB EDO
Quantum Fireball 1280A	Western Digital Caviar AC31600	Quantum Fireball 1080A	Quantum Fireball 1280A	Quantum Grand Prix XP32151S	Quantum Fireball 1080S	Western Digital Caviar AC31600	Western Digital Caviar AC31600	Western Digital Caviar AC31600	Western Digital Caviar AC31600
1.2GB Fast ATA-2	1.5GB EIDE	1GB Fast ATA-2	1.2GB Fast ATA-2	2GB SCSI-3	1GB SCSI-3	1.5GB EIDE	1.5GB EIDE	1.5GB EIDE	1.5GB EIDE
CTX 1565D	Gateway CrystalScan 17	IBM G70	ADI ADI4V	ADI ADI4V	Mitsuba P766DU	NEC MultiSync XV 17	Delta/PerComp DA-1765 VAF	Micro Electronics P766DU	MAG InnoVision DX17F
15, 14	17, 16	17, 16	15, 14	15, 14	17, 16.5	17, 15	17, 16	17, 16.5	17, 16
Number Nine 9FX Motion 771	Matrox MGA Millennium	Matrox MGA Millennium	Diamond Stealth64 Video 3240	Diamond Stealth64 Video 3240	Diamond Stealth64 Video 3240	Matrox MGA Millennium	Matrox MGA Millennium	Diamond Edge 3D 2220	STB PowerGraph 64 Video
2MB VRAM	4MB WRAM	4MB WRAM	2MB VRAM	2MB VRAM	2MB VRAM	2MB WRAM	2MB WRAM	2MB DRAM	2MB EDO DRAM
TEAC CD-56E	Weames CDD-620	TEAC CD-56E	TEAC CD-56E	Plexor PX-63CS	Sony CDU-76S	TEAC CD-56E	TEAC CD-56E	Aztech CDA 668-011	Aztech CDA 668-011
6X ATAPI	6X ATAPI	6X ATAPI	6X ATAPI	6X SCSI	4X SCSI-2	6X ATAPI	6X ATAPI	6X ATAPI	6X ATAPI
Turtle Beach Monte Carlo	Ensoniq 9528	Creative Labs Sound Blaster AWE32 Value Ed.	Creative Labs Sound Blaster AWE32 Value Ed.	Creative Labs Sound Blaster AWE32 Value Ed.	Creative Labs Vibra 16	OPTI 82C930	Creative Labs Sound Blaster 32	Diamond Telecommander	Ensoniq Soundscape
ISA card	ISA card	ISA card	ISA card	ISA card	Motherboard	Motherboard	ISA card	ISA card	ISA card
Labtec LCS3211	Altec Lansing ACS400	S3 Model 10	Advent AV270	Advent AV270	Juster DC-691	NEC	MIDI Land MLI-95	Labtec LCS3210	Altec Lansing ACS31
Amquest V.34 Hypermodem	US Robotics Sportster 28.8 V	None	None	None	None	None	None	Diamond Telecommander	AsKey V.34 Fax Modem
28.8/14.4 Kbps	28.8/14.4 Kbps	N/A	N/A	N/A	N/A	N/A	N/A	28.8/14.4 Kbps	28.8/14.4 Kbps
256K pipelined-burst	256K pipelined-burst	256K pipelined-burst	256K synchronous	256K synchronous	256K pipelined-burst	256K pipelined-burst	256K pipelined-burst	256K pipelined-burst	256K pipelined-burst
EPS	Intel	Intel	Micronics	Micronics	Intel	NEC	PerComp	Acer	Intel
Intel Triton	Intel Triton	Intel Triton	Intel Triton	Intel Triton	Intel Triton	Intel Triton	Intel Triton	Intel Triton	Intel Triton
Award 4.50PG	AMI 1.00.01CNO	AMI 0.05.03.CCOM	Phoenix 4.04	Phoenix 4.04	AMI 1.0	Phoenix 4.05.C	Award 4.50PG	Phoenix 4.04	AMI 1.00C80 v.2.0
128MB	128MB	128MB	128MB	128MB	128MB	128MB	128MB	128MB	128MB
4 ISA, 4 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA	3 ISA, 2 PCI/ISA	4 ISA, 4 PCI, 1 PCI/ISA	4 ISA, 4 PCI, 1 PCI/ISA	3 ISA, 4 PCI, 1 PCI/ISA	3 ISA, 1 PCI, 1 PCI/ISA	4 ISA, 3 PCI	4 ISA, 4 PCI, 1 PCI/ISA	4 ISA, 3 PCI
3, 2	3, 1	2, 1	3, 1	3, 1	4, 1	3, 1	2, 2	3, 2	4, 1
0, 2	0, 3	0, 2	0, 2	0, 2	0, 4	0, 1	0, 1	0, 4	0, 2
230W	200W	200W	230W	200W	250W	200W	230W	200W	250W
1, 2, 0	1, 2, 1	1, 2, 1	1, 2, 1	1, 2, 1	1, 2, 0	1, 2, 1	1, 2, 0	1, 2, 0	1, 2, 0
■	■	■	■	■	■	■	■	■	■
3 years/1 year Included	3 years/1 year Included	3 years/3 years Included	3 years/1 year Included	3 years/1 year Included	2 years/2 years Included (2 years)	3 years/3 years Included	1 year/1 year Included	3 years/3 years N/A	1 year/1 year Included

of WRAM helped the system achieve an average Graphics WinMark 96 score. The unit included 256K of L2 cache, which can be upgraded to 512K for \$75.

The system comes with a three-year-parts, one-year-labor warranty, and free lifetime technical support.—*Charles Lin*
Gateway P5-166 XL. Street price: \$3,789. Gateway 2000 Inc., North Sioux City, SD; 800-846-2000, 605-232-2000; fax, 605-232-2023; <http://www.gw2k.com>. *Circle 465 on reader service card.*

IBM PC Co.

PC 350-P166

Packed with features suited for business computing, including DMI-compliance and an easily serviceable case, the PC 350-P166 desktop machine (\$4,400 street) is a good choice. It also performed well on our benchmark tests. This machine is aptly targeted at the commercial desktop and corporate systems market. IBM PC Co. also sells the PC 700

series of corporate machines, as well as Aptiva home PCs.

Although our test unit came equipped with an integrated S3 Trio64 graphics chip set with 1MB of VRAM, IBM chose to outfit the machine with a Matrox MGA Millennium board with 4MB of WRAM.

The system uses a 166-MHz Pentium CPU, 256K of pipelined-burst L2 cache, 16MB of EDO DRAM, and a Quantum Fireball 1GB hard disk. The PC 350-P166

SUMMARY OF FEATURES

150- and 166-MHz Pentium PCs

■ YES ■ NO

In alphabetical order by company

	Reason Square 5 LX-TR/IE-150	Reason Square 5 LX-TR/IE-166	Robotech Cobra XLT P166	Royal Ultra Media-15	PC MAGAZINE EDITORS' CHOICE SAG STF 150	PC MAGAZINE EDITORS' CHOICE SAG STF 166	Sys Performance P166T
Price of tested configuration	\$2,695 (street)	\$3,495 (street)	\$3,399 (street)	\$2,945 (street)	\$3,900 (street)	\$4,590 (street)	\$3,495 (street)
Processor	Pentium/150	Pentium/166	Pentium/166	Pentium/166	Pentium/150	Pentium/166	Pentium/166
Installed RAM	16MB EDO	16MB EDO	16MB EDO	16MB	16MB EDO	16MB EDO	16MB EDO
Hard disk manufacturer and model	Quantum Fireball 1080A	Quantum Fireball 1080A	Quantum Fireball 1080A	Quantum Fireball 1280AT	Seagate ST32550W	Seagate ST15150W	Quantum Fireball 1280A
Capacity and interface	1GB Fast ATA-2	1GB Fast ATA-2	1GB Fast ATA-2	1 2GB Fast ATA-2	2GB Fast/Wide SCSI-2	4GB Fast/Wide SCSI-2	Two 1 2GB Fast ATA-2
Monitor manufacturer and model	Pacom 5FS	Samsung 17GLSi	Cobra NZ17	MAG InnoVision DX15FG	ViewSonic 17EA	ViewSonic 17EA	MAG InnoVision DX17F
Screen diagonal claimed/measured (inches)	15, 14	17, 16	17, 16	15, 14	17, 16	17, 16	17, 16
Graphics adapter	Diamond Stealth64 Video 2201	Diamond Stealth64 Video 3240	Diamond Stealth64 Video 3240	Diamond Stealth64 Video 3240	Number Nine Imagine 128	Number Nine Imagine 128	Diamond Stealth64 Video 3240
Memory	2MB DRAM	4MB VRAM	2MB VRAM	2MB VRAM	4MB VRAM	4MB VRAM	2MB VRAM
CD-ROM drive	TEAC CD-56E	TEAC CD-56E	TEAC CD-56E	Aztech CDA 668-011	Sony CDU-76S	Sony CDU-76S	NEC CDR-512
Drive speed and interface	6X ATAPI	6X ATAPI	6X ATAPI	6X ATAPI	4X SCSI-2	4X SCSI-2	6X SCSI-2
Sound adapter	Creative Labs Vibra 16S	Creative Labs Vibra 16S	Cobra Wave	Creative Labs Sound Blaster AWE32 Value Ed.	Creative Labs Sound Blaster 32	Creative Labs Sound Blaster 32	Creative Labs Sound Blaster 16
Interface	Motherboard	Motherboard	ISA card	ISA card	ISA card	ISA card	ISA card
Speakers	Yamaha YST-M10	Altec Lansing ACS31	Yamaha YST-M10	MIDI Land MLI 691H	Integrated on monitor	Integrated on monitor	Kingtex EP-88
Modem manufacturer and model	None	None	Boca MV 34i	BJMT 14.4	Boca MV 34i	Boca MV 34i	None
Speed (data/fax)	N/A	N/A	28.8/14.4 Kbps	14.4/14.4 Kbps	28.8/14.4 Kbps	28.8/14.4 Kbps	N/A
Motherboard Components							
Installed external RAM cache and type	256K synchronous	512K pipelined-burst	512K pipelined-burst	256K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst
Motherboard manufacturer	Intel	Intel	Robotech	Royal	SAG Electronics	SAG Electronics	ASUSTek
Chip set manufacturer and model	Intel Triton	Intel Triton	Intel Triton	Intel Triton	Intel Triton	Intel Triton	Intel Triton
BIOS manufacturer and version (or date)	AMI 1.00.03C80	AMI 1.00.03.C80	Award 4.50PG	Award 4.50PG	Award 2.0	Award 4.50PG	Award 4.50PG
Expandability							
Maximum RAM	128MB	128MB	128MB	128MB	512MB	512MB	128MB
Expansion-bus slots	2 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA	4 ISA, 3 PCI, 1 PCI/ISA	3 ISA, 3 PCI, 1 PCI/ISA	4 ISA, 3 PCI, 1 PCI/ISA	4 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA
Accessible drive bays (5.25", 3.5")	3, 1	3, 1	4, 1	3, 2	5, 2	5, 2	3, 2
Internal drive bays (5.25", 3.5")	0, 2	0, 2	0, 4	0, 3	1, 2	1, 2	0, 2
Power-supply wattage	200W	200W	230W	230W	300W	300W	230W
Parallel, serial, mouse ports	1, 2, 0	1, 2, 0	1, 2, 0	1, 2, 0	1, 2, 0	1, 2, 0	1, 2, 0
Service and Support							
7-day, 24-hour live technical support	☐	☐	☐	☐	☐	☐	☐
Standard warranty on parts/labor	3 years/6 years	3 years/6 years	2 years/lifetime	1 year/lifetime	2 years/1 year	2 years/1 year	Varies/1 year
On-site service charge (first year)	\$49	\$49	Included	N/A	\$75	\$75	\$95

N/A—Not applicable: The product does not have this feature

also includes a 6X CD-ROM drive, a Sound Blaster AWE32 wavetable sound card, and IBM's G70 17-inch monitor.

The PC 350-P166 posted average scores on our Disk WinMark 96, Graphics WinMark 96, and Winstone 96 tests.

Setting up the system is a breeze. IBM provides a handy installation diagram with step-by-step directions. And once you have your PC running, IBM Welcome Center software will guide you through configuring and using your computer. The PC 350-P166 features IBM's

SelectaSystem, which allows you to choose your OS upon start-up; you can choose Windows 95, OS/2 Warp, or Windows 3.1. IBM's NetFinity client software, CoSession, and Q&A Plus diagnostics are also included.

IBM offers a three-year warranty with the PC 350-P166. The warranty also includes one year of on-site service.—**CL PC 350-P166.** Street price: \$4,400. IBM PC Co., Somers, NY; 800-426-2968; fax, 800-426-4329; <http://www.ibm.com>. Circle 450 on reader service card.

Micron Electronics Inc.

P150 Millennium, P166 Millennium Plus

Rock-solid performance and clean design are what Micron Electronics offers to business and home-office users with the \$3,047 P150 Millennium and the \$4,446 P166 Millennium Plus. Both street prices include features to satisfy any power user. A tool-free mini-tower case allows easy upgrades as your business needs grow. Micron also sells the Home

Ends

USAFlex PT-166 Ultimate Multi- media Tower	US Computer Patriot LX 166	Vektron Home Office Pro-P150	ZDS Z-Station GT	Zenon Dream Media P-150	Zenon Dream Media P-166
\$4,395 (street)	\$3,499 (street)	\$2,895 (street)	\$3,463 (street)	\$2,499 (street)	\$2,829 (street)
Pentium/166	Pentium/166	Pentium/150	Pentium/150	Pentium/150	Pentium/166
16MB EDO	16MB EDO	16MB EDO	16MB	16MB EDO	16MB EDO
Western Digital Caviar AC31600	Quantum Fireball 1280A	Western Digital Caviar AC31600	Western Digital Caviar AC31800	Quantum Fireball 1080A	Western Digital Caviar AC31600
1.5GB EIDE	1.2GB Fast ATA-2	1.5GB EIDE	1.5GB EIDE	1GB Fast ATA-2	1.5GB EIDE
MAG InnoVision DX17F	Wyse WY-15E	MAG InnoVision DX15F	ZDS ZCM-1540	MAG InnoVision DX15F	MAG InnoVision DX15F
17, 16	15, 14	15, 14	15, 13	15, 14	15, 14
Number Nine Vision 330	Diamond Stealth64 Video 3240	Diamond Stealth64 Video 3240	Diamond Stealth64 Video 2201	Diamond Stealth64 Video 3240	Diamond Stealth64 Video 3240
2MB VRAM	2MB DRAM	2MB VRAM	2MB VRAM	2MB VRAM	2MB VRAM
Acer CD- 665A-002	TEAC CD-58E	TEAC CD-58E	Sanyo CDR-S16	Goldstar GCD-R542B	Goldstar GCD-R542B
5X ATAPI	6X ATAPI	6X ATAPI	4X ATAPI	4X ATAPI	4X ATAPI
Crystal Labs Multimedia	Creative Labs Sound Blaster AWE32 Value Ed.	Creative Labs Sound Blaster 32	Creative Labs Vibra 16S	Creative Labs Sound Blaster 16	Creative Labs Sound Blaster 16
Daughterboard	ISA card	ISA card	ISA card	ISA card	ISA card
Altec Lansing ACS31	Premier LS-80	Yamaha YST-M10	MIDI Land MLI 691H	MIDI Land MLI-178	MIDI Land MLI-178
Boca MV.34i	GVC28.8	Supra 288 PnP	None	Micro Direct 28.8	Micro Direct 28.8
28.8/14.4 Kbps	28.8/14.4 Kbps	28.8/14.4 Kbps	N/A	28.8/14.4 Kbps	28.8/14.4 Kbps
256K pipelined-burst	256K pipelined-burst	256K pipelined-burst	256K pipelined-burst	256K pipelined-burst	512K pipelined-burst
Intel	C Point Corp.	SuperMicro	ZDS	ASUSTek	ASUSTek
Intel Triton	Intel Triton	Intel Triton	OPTi Viper	Intel Triton	Intel Triton
AMI 1.00.01CLO	Phoenix 4.04	AMI (10/10/94)	Phoenix 4.05.019	Award 4.50PG	Award 4.50PG
128MB	128MB	128MB	144MB	128MB	128MB
2 ISA, 3 PCI, 1 PCI/ISA	3 ISA, 3 PCI, 1 PCI/ISA	4 ISA, 4 PCI	2 ISA, 1 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA
6, 1	3, 1	3, 2	2, 1	2, 2	2, 2
0, 5	1, 4	0, 1	0, 0	0, 2	0, 2
230W	250W	200W	150W	240W	240W
1, 2, 0	1, 2, 0	1, 2, 0	1, 2, 1	1, 2, 0	1, 2, 0
3 years/lifetime Included	2 years/lifetime \$35	1 year/lifetime \$50	3 years/3 years Included	1 year/1 year \$50	1 year/1 year \$50

Pro series of home PCs and the Pro Magnum series of Pentium Pro machines.

Each of the tested PCs used the Diamond Stealth64 Video 3240 graphics card with 2MB of VRAM and a Sound Blaster AWE32 wavetable sound card. The P150 Millennium used a 1.2GB Quantum Fireball hard disk and a 6X CD-ROM drive. The P166 Millennium Plus included a 2GB Quantum Grand Prix SCSI-3 hard disk and a Plectro SCSI 6X CD-ROM drive—both attached to a BusLogic Fast SCSI controller. The 166-MHz unit also fea-

tured an Iomega Jaz drive, which provided 1GB of additional, removable storage. Microsoft Office 95 Professional is bundled with both units.

Both units earned average scores on our Winstone 96 tests in their respective CPU classes. Other test scores for the P150 Millennium were average, except for its above-average CD-ROM WinMark 96 score and below-average Graphics WinMark 96 score. The P166 Millennium Plus distinguished itself on our Disk WinMark 96 and CD-ROM WinMark 96 tests, gar-

nering top-five scores on each within its processor class.

A step-by-step setup poster, labeled connectors, and the Micron On-Line Guide will assist you from the time you open the box. The units each have a one-year warranty, with on-site service included.—CL

P150 Millennium. Street price: \$3,047. **P166 Millennium Plus.** Street price: \$4,446. Micron Electronics Inc., Nampa, ID; 800-388-6334, 208-463-3434; fax, 208-463-3424; <http://www.mei.micron.com>. Circle 451 on reader service card.

Mitsuba Corp.

Premier System 166

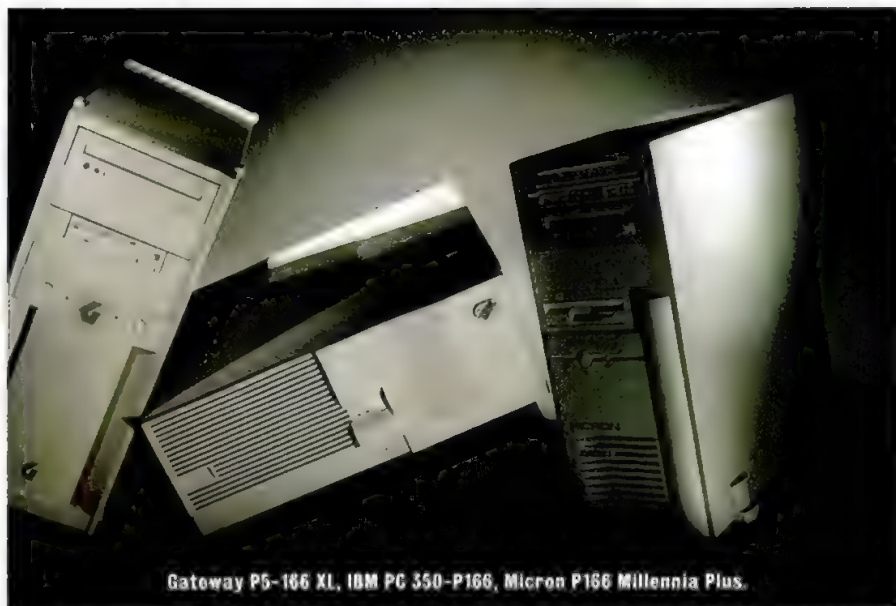
Mitsuba Corp. targets its Premier System 166 (\$3,900 street) at corporate PC buyers. This Pentium/166-based machine should serve its audience well, with performance that effectively kept pace with the competition. Mitsuba also sells the Professional 486 Series and the Executive Pentium Series of business PCs.

The midtower system was configured with a 1GB Quantum Fireball 1080S SCSI-3 hard disk and a Sony quad-speed SCSI CD-ROM drive. Integrated on its motherboard is a 16-bit Creative Labs Vibra 16 FM synthesis audio chip set. Graphics are handled by a Diamond Stealth64 Video VRAM PCI graphics board with 2MB of VRAM.

The Premier System 166 also had a unique feature: an Epson DYO 211 combination 1.44MB floppy disk and PC Card drive. The unit can accommodate either one Type II or one Type III PC Card. The system also came with a set of Juster Active speakers and a 17-inch monitor.

The Premier System 166 was an average performer on our Winstone 96, Disk WinMark 96, and CD-ROM WinMark 96 tests. When tested with full-motion videos, the unit performed well.

The system came with Microsoft Office Professional and Bookshelf for Windows 95. Mitsuba offers a two-year warranty with two years of on-site service.—RSA
Premier System 166. Street price: \$3,900. Mitsuba Corp., LaVerne, CA; 800-648-7822, 909-392-2000; fax, 909-392-2021; <http://www.mitsuba.com>. Circle 469 on reader service card.



Gateway P5-166 XL, IBM PC 350-P166, Micron P166 Millennium Plus.

NEC Technologies Inc.

PowerMate P166

Features such as DMI compliance and NetWare client certification make NEC Technologies' PowerMate P166 (\$4,169 street) a good choice for corporate buyers. This sturdy Pentium/166-based mini-tower offers many integrated devices, is easy to set up, and delivers solid performance. NEC markets three different PC lines to the corporate buyer: the PowerMate P line of high-end Pentium systems, the PowerMate V line of value-oriented Pentium units, and the Pro line of Pentium Pro workstations. For the home buyer, NEC offers the Ready line.

Installation of the PowerMate P166 is nearly foolproof. NEC provides a setup poster, color-coded connectors, and the NEC Online Guide, complete with graphics.

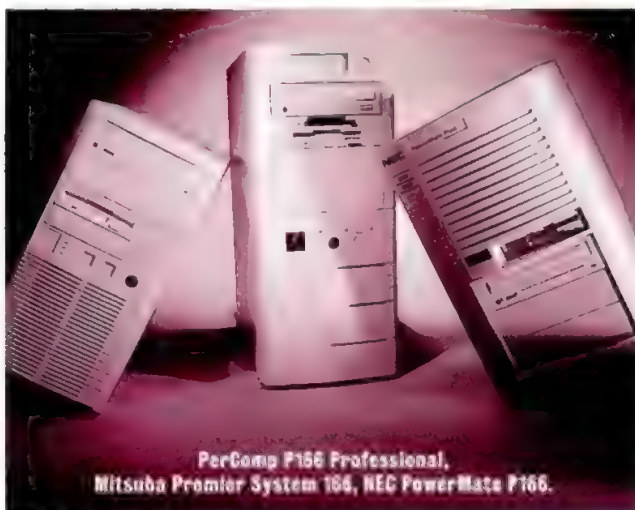
The PowerMate P166 ships with a 6X CD-ROM drive, an NEC MultiSync 17-inch monitor (NEC sells system units and monitors separately; the monitor we received is a \$700 option included in the total price above), and a pair of speakers. The integrated audio supports both FM and wavetable synthesis

(the latter is a \$70 option included in the above price). The unit is also equipped with a serial infrared interface and Puma's TranXit software.

Equipped with 256K of pipelined-burst SRAM, EDO DRAM, and a Matrox MGA Millennium graphics card with 2MB of WRAM, the unit managed average Winstone 96 and Disk WinMark 96 scores and an above-average Graphics WinMark 96 score. Its CD-ROM WinMark 96 score was also above average.

The PowerMate P166 has a three-year warranty with one year of on-site service.—CL

PowerMate P166. Street price: \$4,169. NEC Technologies Inc., Boxborough, MA; 800-632-4636, 508-264-8000; fax, 800-366-0476; <http://www.nec.com>. Circle 453 on reader service card.



PerComp P166 Professional, Mitsubishi Premier System 166, NEC PowerMate P166.

PerComp Microsystems Inc.

PerComp P166 Professional

For a Pentium/166 system, PerComp Microsystems' PerComp P166 Professional (\$3,449 street) provides the user with an average level of performance. The mini-tower unit is at the top of PerComp's Professional series of Pentium machines, which is designed for corporate and home users who need extra processing power for demanding applications such as CAD/CAM and desktop publishing.

The P166 Professional was configured with a 1.5GB hard disk and a TEAC 6X CD-ROM drive. It was packaged with a 17-inch Delta/PerComp monitor and a set of MLI-95 powered speakers.

Inside, the unit was set up with a Matrox MGA Millennium PCI graphics board with 2MB of WRAM and a Creative Labs Sound Blaster 32 wavetable sound board. All system manuals and utility disks were presented in convenient three-ring binders.

The P166 Professional yielded average scores on our Winstone 96, Disk WinMark 96, and Graphics WinMark 96 tests. It did, however, yield an above-average CD-ROM WinMark 96 score, thanks in part to its use of a 6X CD-ROM drive.

PerComp, a direct vendor, backs the system with a one-year warranty, with one year of free on-site service. Technical support is also available 24 hours a day, 7 days a week.—RSA

PerComp P166 Professional. Street price: \$3,449. PerComp Microsystems Inc., Richardson, TX; 800-856-6688, 214-234-2198; fax, 214-234-8658; <http://www.percomp.com/PC>. Circle 471 on reader service card.

PowerSpec

PowerSpec*PC Reference Series P166

The PowerSpec*PC Reference Series P166 (\$3,878 street), the top-of-the-line offering in PowerSpec's high-end Reference Series of PCs, targets serious power users. Micro Center, PowerSpec's parent company, sells PowerSpec machines via phone and

A PEANUT FARMER
from Georgia was elected
to the **OVAL OFFICE**.

AN APE scaled the World
Trade Center and smashed
BOX OFFICE RECORDS.

POLYESTER became the
en vogue wonder fabric in
everyone's wardrobe.

A STARRY-EYED DREAMER
named Stan Shih set out to
create a billion-dollar **GLOBAL**
COMPUTER COMPANY with
a donation from his **MOM**.



ACER presents the hard-to-believe Formative Years: 1976-1980

1976

With the aid of a maternal contribution and a total of \$25,000, Stan Shih founds Acer® as Multitech International and begins his dream for a microprocessing enterprise.

Stout first brother upholds the dignity of his brother's Presidential status by licensing his name to a beer company.

1977

During an interview, Stan Shih tells prospective employee William Lu the company may go bankrupt. 18 years later, Lu is president of Acer Computer International, managing millions in global business.

Who could possibly play a thin-as-a-rail droid in the most successful science fiction film ever? The 90-pound British actor who was thin-as-a-rail enough to fit inside his armor.

1977

Acer America Corporation is established by Stan Shih for manufacturing, assembling, marketing, and selling microprocessor-driven technology throughout North America.

Charlie's Angels tops Nielsen ratings, proving that six-foot blondes with feathered hair are the archetypal detective heroes of the seventies.

1976

When everyone else sees typewriters as the core of productivity, Taiwanese entrepreneur Stan Shih envisions the microprocessor as the engine of business.

After keeping a low profile for 3,300 years in an Egyptian tomb, King Tut flaunts his wealth across America in an extravagant seven-city tour.

Acer assumes leadership role as high-tech gurus by opening a microprocessing center and training 3,000 engineers for Taiwan's information industry.

1978

Prank-happy, beer-swilling fraternity failures reach celebrity status when National Lampoon's Animal House debuts on big screen.

Human egg is fertilized outside female womb and world's first test tube baby is born. And you thought hospitals were sterile.

1978

To promote computer literacy in Taiwan, Acer publishes Microprocessor Bulletin and establishes credibility in microprocessing savvy.

Multitech International begins incorporating microprocessors into electronic games and taps into rapidly growing consumer technology market.

1977

The King of Rock and Roll dies and is born again in cheesy Vegas lounges where desperate actors don the jumpsuit and sideburns to eke out a living.

Stan Shih's dignified business partner and wife Carolyn Yeh scrubs office floors and schleps around Taipei on a scooter distributing Acer bills.

1979

Headband-sporting tennis prima donna trademarks his million-dollar recipe for success with racket-throwing fits and prolonged swearing-at-the-umpire outbursts.

Acer introduces Chinese language CRT terminal and subsequently receives Taiwan's most prestigious design award.

1980

Millions show concern for a ruthless oil snake who destroys lives for pleasure when they tune in to watch the "Who Shot J.R." episode of Dallas.

Juggernaut Russian Ice Hockey team slips up to a bunch of college boys from the United States at the Lake Placid Winter Olympics.

Acer starts mass-producing micro-processor-driven computer components for local manufacturers and begins exporting CRT terminals in bulk.

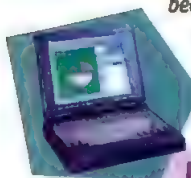
1980

Who would have thought a company could be so far ahead of its time?

Yet even in the age of the information superhighway, Acer continues to pave the road.



To meet the demands of tomorrow, PC technology must be more advanced, accessible, and flexible than ever. That's why we deliver cutting-edge PC systems and components around the world. Acer always delivers the freshest technology—because all our global factories are located in key technology markets. Our research and development center in San Jose, California, has been setting the pace for years. They developed the first RISC-based PC, the first symmetric multiprocessing server, and the first 64-bit architecture for Windows NT."



It's incredible what our new products can do!



Since Acer components and systems are modular, you can always expand your capabilities while protecting your investment. Even quality is never an issue. We originally manufacture all our own hardware from the ground up. And every Acer factory has met the strictest ISO-9000 standards. Our forward-thinking philosophy has catapulted us into the top ten echelon of PC companies. Today we're a four billion-dollar business with a formidable presence in 37 countries. So we can actually afford to hire a janitor to scrub our office floors.

If all this is making you shake your head in disbelief, wait until you read our next installment, 1981-1985

Building on 20 Years of Value and Service

Acer



**These
NOTEBOOKS
can adapt to
any situation.**

**Too bad we can't
say the same for
BABY-BLUE LEISURE SUITS.**

While the slick seventies fashions have come and gone, two things will never go out of style. That's the AcerNote™ Pro and AcerNote Light notebooks. As modular portables, they give you the flexibility to change system hardware according to the task at hand. The AcerNote Pro features three modular bays that can house a CD-ROM drive, lithium ion batteries, a floppy drive, and a hard drive in several configurations. The AcerNote Light has a floppy drive module that swaps with a second lithium ion battery or a PCMCIA type III module in seconds. (And it weighs a paltry five pounds.) For multimedia presentations, network connectivity, faxing, additional power, and extra storage, AcerNote notebooks offer plenty of options. With the full-throttled power of a 75MHz Pentium® processor or a Cyrix™ 5x86 processor, they're also robust enough for the most demanding applications. And both come preloaded with Windows® 95, the operating system of the future. So they'll never end up in the mothballs with all that lovely polyester.

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- New business purchase program



"Its bright, spacious screen makes the most of Windows 95."
—Computer Shopper, 12/95

AcerNote Pro P75MHz

- 75MHz Intel Pentium Processor
- 6MB System RAM (Expandable to 40MB)
- 10.4" Dual-Scan LCD Displays 256 Colors
- 500MB Externally Removable 2.5" Hard Disk Drive
- 256KB L2 Cache
- 2 PCMCIA Type II/1 Type III Slot
- Externally Removable 1.44MB Diskette Drive
- Secondary Lithium Ion Battery Option
- 1MB PCI Bus Video with Graphics Accelerator
- 16-Bit Sound Blaster™ and Windows Sound Systems- Compatible Stereo Audio Onboard with Built-In Speaker and Microphone
- Slim 8.9" x 11.7" x 1.97" System Case Weighs 6.4 lbs., Including NiMH Battery
- Personal Organizer and Hoyle® Classic Card Games Included
- Microsoft® Windows 95
- Three-Year Limited Warranty with One-Year Next-Business-Day Replacement in the U.S. and Canada

\$2,499

Business Leasing Available

SAME CONFIGURATION AS ABOVE WITH:

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- 800MB Externally Removable 2.5" Hard Disk Drive

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Business Leasing Available

AcerNote Pro P120MHz

- 120MHz Intel Pentium Processor
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- Externally Removable 1000MB 2.5" Hard Disk Drive

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AcerNote Light Cyrix 5x86

- 100MHz low-voltage Cyrix 5x86 Processor with 64-Bit Internal Data Path and 16KB Write-Back Cache
- 8MB System RAM (Expandable to 32MB)
- 10.4" Dual-Scan LCD Displays 256 Colors
- 540MB Upgradable Hard Disk Drive
- 1 PCMCIA Type II Slot (1 PCMCIA Type III Slot Module Available as Accessory)
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Docking Station Features Include:

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- Quad-Speed CD-ROM Drive
- 2-Button Mouse
- Standalone Speakers
- Standard Keyboard
- 3 ISA Expansion Slots, 3 Storage Bays (1 Internal/2 External)
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- Built-In Battery Charger Bay



\$799

Business Leasing Available



Acer





Quantex QP5/166 SM-2, Reason Square 5 LX-TR/IE-166, PowerSpec® PC Reference Series P166.

through its retail stores. The Reference Series P166 offers mostly average performance, with graphics performance an unfortunate exception. PowerSpec also markets a value line.

The Reference Series P166 is a Pentium/166-based midtower. 256K of external processor cache and 16MB of EDO DRAM helped the unit achieve an average Winstone 96 score. Equipped with a 1.5GB EIDE hard disk, the machine also posted an average Disk WinMark 96 score. Using a Diamond Edge graphics card with the SGS Thomson STG 2000 graphics chip set and 2MB of DRAM, the system garnered a below-average Graphics WinMark 96 test score. The unit's CD-ROM WinMark 96 score was also below average. Those results foreshadowed the machine's poor performance on our Full-Screen Scaling tests, on which it dropped a significant number of frames from video clips.

The Reference Series P166 also comes with a 17-inch monitor, a 28.8-/14.4-Kbps data/fax modem, and an Aztech 6X CD-ROM drive. A 16-bit Diamond Telecommander sound card that supports FM synthesis (wavetable synthesis support is provided by the graphics board) and Labtec speakers make up the audio portion of this system.

The PowerSpec unit has a three-year parts-and-labor warranty. No on-site service is available.—*MEB*

PowerSpec® PC Reference Series P166. Street price: \$3,878. PowerSpec, Columbus, Ohio; 703-204-8420; fax, 703-204-8401. Circle 472 on reader service card.

Quantex Microsystems Inc.

QP5/166 SM-2

The QP5/166 SM-2 is Quantex Microsystems' top-of-the-line unit in its SM line, geared toward the small-office/home-office user. With a \$3,299 street price, the QP5/166 SM-2 is a solid performer offered at a fair rate. To sweeten the deal, Quantex includes an abundant software bundle. Quantex's other offerings include the M line, designed for family use, and the WS line, meant to serve as

workstations.

EDO DRAM and 256K of L2 cache seem to be standard issue in this roundup, and the Pentium/166-based QP5/166 SM-2 is no exception to the rule. The system garnered benchmark test scores that were on a par with its 166-MHz competition. It posted its only below-average test score on our CD-ROM WinMark 96 tests.

The system came with a 1.5GB hard disk, an STB PowerGraph 64 Video card with an S3 Trio64V+ chip set and 2MB of EDO DRAM, and an Aztech 6X CD-ROM drive. The unit's sound card was the Ensoniq Soundscape, capable of FM and wavetable synthesis. Altec Lansing ACS31 speakers, a 17-inch MAG monitor, and a 28.8-/14.4-Kbps data/fax modem completed the package.

The QP5/166 SM-2 came with Quan-

tex's Professional software bundle, including titles such as Novell's PerfectOffice, Quattro Pro, Quicken Financial Suite, and SharkWare, a personal organizer. The Professional bundle will also include NetCruiser Plus by the time you read this.

Quantex supports this machine with a one-year warranty that includes on-site service.—*MEB*

QP5/166 SM-2. Street price: \$3,299. Quantex Microsystems Inc., Somerset, NJ; 800-760-9001, 908-563-4166; fax, 908-563-0407; <http://www.quantex.com>. Circle 473 on reader service card.

Reason Technology Inc.

Square 5 LX-TR/IE-150, Square 5 LX-TR/IE-166

The two units from Reason Technology, the Square 5 LX-TR/IE-150 (\$2,695 street) and the Square 5 LX-TR/IE-166 (\$3,495 street), each offer good performance, a comprehensive set of components, and a generous warranty for the price. The Pentium/166-powered LX-TR/IE-166 may be more of a bargain, though; besides a faster CPU, this model offers a larger monitor, better speakers, and slightly better overall performance within its CPU class.

These systems are geared toward high-end home-office and corporate users. Reason also offers the Sence line of industrial PCs.

The two tower units generally per-



Royal Ultra Media 15, Robotech Cobra XLT P166, SAG STF 166.

150- and 166-MHz Pentium PCs

formed well on our tests. The 166-MHz system posted average marks, with particularly solid scores on our Winstone 96, CPUmark₁₆, and CPUmark₃₂ tests. This unit also had one of the best CD-ROM WinMark 96 scores in this roundup.

The 150-MHz model garnered mostly average scores, except for a below-average Graphics WinMark 96 score and a CD-ROM WinMark 96 score that was above average for its class.

These systems provide labeled ports and include 1GB Quantum Fireball hard disks and 6X CD-ROM drives. The LX-TR/IE-150 has 256K of L2 cache, Yamaha speakers, and a 15-inch monitor, and the LX-TR/IE-166 has 512K of L2 cache, Altec Lansing ACS31 speakers with a subwoofer, and a 17-inch monitor.

The Reason systems each come with a generous warranty that basically covers three years on parts and six years on labor, although there is limited coverage on parts during the fourth through sixth years. On-site service is an additional \$49 per unit for one year.—AY

Square 5 LX-TR/IE-150. Street price: \$2,695.
Square 5 LX-TR/IE-166. Street price: \$3,495. Reason Technology Inc., Minneapolis, MN; 800-800-4860, 612-780-4792; fax, 612-780-4797; CompuServe, 76040, 201. *Circle 474 on reader service card.*

Robotech Inc.

Cobra XLT P166

The Cobra XLT P166 (\$3,399 street), from Robotech, not only posted competitive scores on our benchmark tests, it also came with a great software bundle that included Novell's PerfectOffice. This machine is aimed at high-end graphics and business users.

The Cobra XLT P166 is a tower system based on a 166-MHz Pentium processor backed by 512K of pipelined-burst external processor cache and 16MB of EDO DRAM. All of these components contributed to the unit's average Winstone 96 score. The 1GB Quantum Fireball hard disk and the Diamond Stealth64 Video 3240 graphics card helped the Cobra achieve average scores on our Disk WinMark 96 and Graphics WinMark 96 tests. The system's only above-average score was on our CD-ROM WinMark 96 tests, thanks to a TEAC 6X CD-ROM drive.

Sound is supplied by a 32-bit Cobra Wave sound card (which supports FM and wavetable synthesis) and Yamaha speakers. A 17-inch monitor and 28.8-/14.4-Kbps data/fax modem round out the package.

Robotech includes a large software bundle with its system: Envoy, NASCAR Racing, and Quattro Pro are a few of the titles included. Robotech also eases setup and maintenance with an included setup guide and spring-loaded drive cages.

The Cobra XLT P166 comes with a two-year parts and lifetime labor warranty. The vendor also includes on-site service for your first year with the unit. Three additional years of on-site service are available for \$199.—MEB

Cobra XLT P166. Street price: \$3,399. Robotech Inc., Midvale, UT; 800-533-0633, 801-565-0645; fax, 801-565-0680; robotech@xmission.com. *Circle 476 on reader service card.*

Royal Computers Inc.

Ultra Media-15

Royal Computers has designed its Ultra Media-15 (\$2,945 street) for home, small-office, and home-office buyers. This Pentium/166-based unit, an average performer on our benchmark tests, offers a great software bundle that includes Novell's PerfectOffice. Royal also markets the Perfect Home Media line of PCs, geared toward home multimedia use, and the high-end Power

Media Plus line for business professionals.

The Ultra Media-15 was one of the few machines in this roundup to include standard DRAM. This did not adversely affect benchmark-test performance, however; most of the system's scores were within the average range for its CPU class. The unit had one below-average test score, on our CD-ROM WinMark 96 test.

Royal's Ultra Media-15

combines competitive

performance with a

great software bundle.

The Royal System also featured 256K of secondary processor cache and a 1.2GB Quantum Fireball hard disk.

Graphics are handled by the Diamond Stealth64 Video 3240 card with the S3 Vision968 chip set and 2MB of VRAM. The package includes a 15-inch monitor and a 14.4-Kbps fax modem. A 6X CD-ROM drive, a Creative Labs Sound Blaster AWE 32 sound card with FM and wavetable synthesis, and a pair of MLI speakers are included for your multimedia needs.

Royal bundles Microsoft Encarta 95, Microsoft Money, and Microsoft Works as well as Novell's PerfectOffice. The vendor provides a one-year-parts, lifetime-labor warranty and a 30-day money-back guarantee with the unit.—MEB



Flex Ultimate PT-166 Multimedia Tower, US Computer Patriot Lx 166, Sys Performance P166T.



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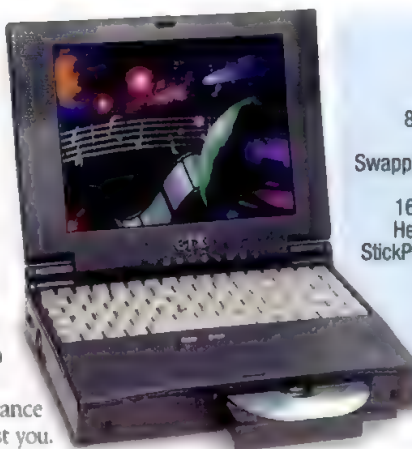
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Ultra Media-15. Street price: \$2,945. Royal Computers Inc., Industry, CA; 800-486-0008, 818-855-5077; fax, 818-330-2717. *Circle 477 on reader service card.*

SAG Electronics

SAG STF 150, SAG STF 166



Built as high-end business machines, SAG Electronics' SAG STF 150 (\$3,900 street) and SAG STF 166 (\$4,590 street)—both Editors' Choice recipients in this roundup—certainly deliver on performance.

Both produced the best Winstone 96, Graphics WinMark 96, and Disk WinMark 96 scores in their respective CPU classes. These tall towers also provide plenty of space, so you have room to grow. SAG designed the units for use as CAD and graphics workstations or as servers.

The STF 150 and STF 166 are bundled with Sony quad-speed CD-ROM drives, Sound Blaster 32 sound cards with FM and wavetable synthesis, and 28.8-/14.4-Kbps data/fax modems. The systems also use Number Nine's Imagine 128 graphics cards with 4MB of VRAM and ViewSonic 17-inch monitors with built-in speakers.

The SAG PCs each have 512K of pipelined-burst L2 cache. The STF 166 came with a 7,200-rpm, Fast/Wide SCSI-2, 4GB hard disk; a 2GB version was installed in the STF 150. Along with excelling on our Winstone, Graphics WinMark, and Disk WinMark tests, the units also did well on our video-playback and CPU tests. But because they used quad-speed CD-ROM drives (most of the competition used 6X or faster drives), the two units had below-average CD-ROM WinMark 96 scores.

The systems each have a two-year-parts and one-year-labor warranty. One year of on-site service costs \$75. SAG's warranty guarantees a 24-hour response.—CL

SAG STF 150. Street price: \$3,900. **SAG STF 166.** Street price: \$4,590. SAG Electronics, Andover, MA; 800-989-3475; fax, 508-689-0180. *Circle 478 on reader service card.*

Sys Technology Inc.

Sys Performance P166T

Sys Technology built the Sys Performance P166T as an all-purpose computer for power users and corporate buyers. The midtower (\$3,495 street) was an average performer on all of our tests. The P166T was also the only system in the roundup with dual hard disks.

The P166T comes with a Diamond Stealth64 Video 3240 graphics card with 2MB of VRAM, an NEC 6X CD-ROM drive, a Sound Blaster 16 audio card with FM-synthesis sound, and a MAG InnoVision DX-17F 17-inch monitor. The included Kingtex EP-88 speakers had a somewhat dull sound quality but were otherwise acceptable.

The Sys machine uses an ASUSTek motherboard equipped with a Pentium/166 processor, 512K of L2 cache, 16MB of EDO DRAM, and two 1.2GB Quantum Fireball hard disks. On our benchmark tests, this unit was an average performer across the board, with one highlight: an above-average CD-ROM WinMark 96 score.

Sys offers a one-year-labor warranty with the unit. The vendor covers the system pieces according to the individual warranties of the original component manufacturers. An on-site warranty is available for \$95 for the first year.—CL
Sys Performance P166T. Street price: \$3,495. Sys Technology Inc., Cypress, CA; 800-613-9963, 714-821-3900; fax, 714-821-9592; <http://www.systechology.com>. *Circle 454 on reader service card.*

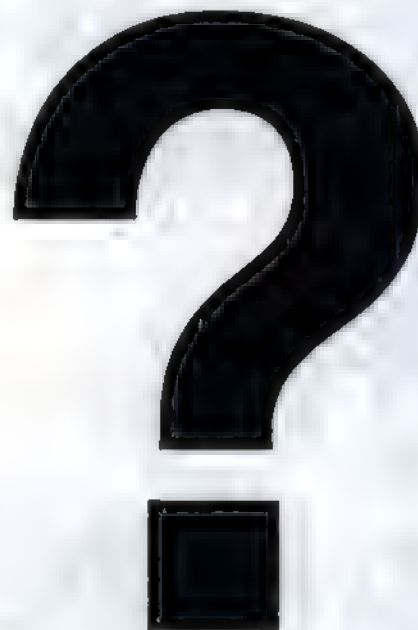
USA Flex Inc.

Flex PT-166 Ultimate Multimedia Tower

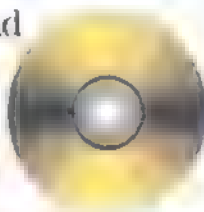
Aimed at power users and home-office professionals, the Flex PT-166 Ultimate Multimedia Tower (\$4,395 street) has one of the most complete multimedia packages we've seen. As part of the home system line of USA Flex PCs, the PT-166 Ultimate ships with a wide selection of applications and entertainment titles, including Novell's PerfectOffice Professional. USA Flex also sells business and home-office machines and outfits them with appropriate software.

The PT-166 Ultimate came with a Number Nine Vision 330 graphics card.

For an interactive CD-ROM kit that will answer a lot of your questions, call 1-800-527-3753, Ext. 1009.

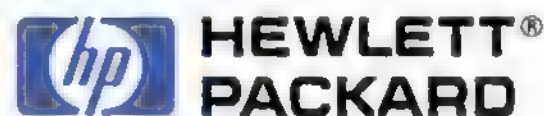


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COVER STORY

150- and 166-MHz Pentium PCs

Integrated sound was enhanced by a Crystal Lake wavetable daughterboard. Other equipment included a 5X CD-ROM drive, Altec Lansing speakers with a powered subwoofer, an internal 28.8-/14.4-Kbps data/fax modem, a 17-inch MAG monitor, and a joystick.

Inside the PT-166 Ultimate you'll find an Intel motherboard with a 166-MHz Pentium CPU, 256K of pipelined-burst L2 cache, 16MB of EDO DRAM, and a 1.5GB hard disk. Setting up the machine is easy: USA Flex includes a quick-setup poster, and connectors are clearly labeled.

On our benchmark tests, the unit was an average performer, except for its below-average scores on our Graphics WinMark 96 and CD-ROM WinMark 96 tests.

USA Flex covers its PC with a three-year-parts, lifetime-labor warranty. One year of on-site service is included.—**CL Flex PT-166 Ultimate Multimedia Tower.** Street price: \$4,395. USA Flex Inc., Bloomington, IL; 800-872-3539, 708-924-6700; fax, 708-351-7204; <http://www.usaflex.com>. Circle 482 on reader service card.

US Computer Direct

Patriot LX 166

The Patriot LX 166, from US Computer Direct, offers average performance for its class and a good price (\$3,499 street) that includes a bundle of home software. The Patriot LX series is aimed at power home users and small-business users. The company also offers two higher-end series: the top-level Patriot Gold Media line, for high-end graphics and server setups, and the Patriot EXL line, which offers larger monitors and hard disks than the LX line.

The Patriot LX 166, a midtower system, was configured with a 1.2GB Quantum Fireball hard disk and a TEAC 6X CD-ROM drive. The system also included a Diamond Stealth Video VRAM graphics board with 2MB of VRAM, a Creative Labs Sound Blaster AWE32 wavetable sound card, and a GVC 28.8-/14.4-Kbps data/fax modem.

The unit was bundled with a home-oriented software package, which included Microsoft Encarta 95, Money, and Works. A getting-started booklet offers extensive help in setting up and troubleshooting.

The Patriot LX 166 yielded average



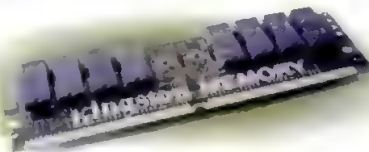
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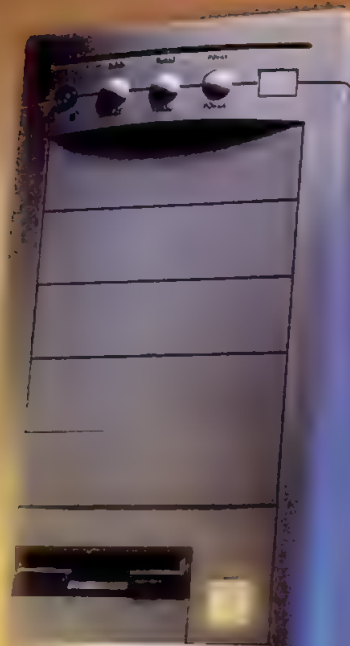
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150- and 166-MHz Pentium PCs

scores on our Winstone 96, Graphics WinMark 96, and Disk WinMark 96 tests. Its CD-ROM WinMark 96 score was one of the best in this roundup.

The unit has a two-year-parts, lifetime-labor warranty. One year of on-site service costs \$35.—*RSA*

Patriot LX 166. Street price: \$3,499. US Computer Direct, Huntington Beach, CA; 800-787-4947, 714-841-4081; fax, 714-841-4262; <http://uscomputer.prtcl.com>. Circle 481 on reader service card.

Vektron

Home Office Pro-P150

As its name suggests, the Home Office Pro-P150 from Vektron aims to provide a complete hardware and software solution for both small-office and home-office users. The \$2,895 (street) mini-tower system offers a competitive price, fair performance, and impressive hardware and software components. Vektron also makes a Power PC line that targets the corporate user; systems range from CAD workstations to Internet servers.

This system is equipped with a Diamond Stealth64 Video 3240 graphics board with 2MB of VRAM. Multimedia components include a 6X CD-ROM drive, a Sound Blaster 32 audio card that supports both FM and wavetable sound, and a set of Yamaha YST-M10 speakers. An internal Supra 288 PnP modem and the included America Online, CompuServe, and NetCom start-up disks can help connect you to the Internet. Vektron completes the package with a 15-inch monitor.

The Vektron system is built around a 150-MHz Pentium CPU. The motherboard is configured with 256K of pipelined-burst SRAM and 16MB of EDO DRAM. The installed 1.5GB hard disk offers plenty of space to install the Microsoft Office 95 Professional Edition and Microsoft Family Pack that comes bundled with the system.

On our tests, the unit came through with average scores on all measures.

Vektron includes a one-year-parts warranty with free lifetime labor. On-site

service contracts are available for \$50 for one year or \$199 for four years.—*CL*

Home Office Pro P-150. Street price: \$2,895. Vektron, Grand Prairie, TX; 800-660-0236, 214-606-0280; fax, 214-606-1278; <http://www.vektron.com>. Circle 483 on reader service card.

Zenith Data Systems

Z-Station GT

The Pentium/150-powered Z-Station GT is the newest addition to Zenith Data Systems' Z-Station line of business PCs. ZDS sells this machine as a high-end desktop or entry-level workstation. The Z-Station GT (\$3,463 street) was the only slimline system in our roundup, providing little room for expansion. This machine was an average to below-average performer on our benchmark tests.

The Z-Station GT is equipped with a Diamond Stealth Video 2201 graphics adapter, a quad-speed CD-ROM drive, a Creative Labs Vibra 16 sound card, speakers, and a 15-inch monitor. Bundled soft-

GT produced average Winstone 96 and Graphics WinMark 96 scores but below-average Disk WinMark 96 and CPUmark scores.

ZDS offers a three-year parts-and-labor warranty with one year of on-site service included.—*CL*

Z-Station GT. Street price: \$3,463. Zenith Data Systems, Buffalo Grove, IL; 800-533-0331, 708-808-5000; fax, 800-472-7211; <http://www.zds.com>. Circle 455 on reader service card.

Zenon Technology Inc.

**Dream Media P-150,
Dream Media P-166**

Zenon Technology combines 150- and 166-MHz Pentium performance with low prices to create the Dream Media P-150 (\$2,449 street) and Dream Media P-166 (\$2,829 street) mini-tower systems. These two average performers are geared toward home-office, CAD, and power-user markets. Zenon also markets the 3D Interactive series, a home-entertainment line of PCs with MPEG support.

Both Zenon systems came equipped with Diamond Stealth64 Video 3240 graphics adapters with 2MB of VRAM, quad-speed CD-ROM drives, Sound Blaster 16 sound cards, and stereo speakers. Completing the packages are 15-inch MAG monitors and 28.8-/14.4-Kbps data/fax modems. A suite of Microsoft software, including Encarta 96, Entertainment Pack, and Money, is also packaged with these PCs; Novell's PerfectOffice is available as a substitute bundle.

The Dream Media P-150 also features 256K of pipelined-burst L2 cache and a Quantum Fireball 1GB hard disk. The unit's performance on our tests was average within its CPU class.

The 166-MHz unit uses 512K of pipelined-burst cache, resulting in strong processor scores. It also includes a 1.5GB hard disk. Other test results were average.

The Dream Media systems are each covered by a one-year warranty. One year of on-site service is \$50.—*CL* □

Dream Media P-150. Street price: \$2,449. **Dream Media P-166.** Street price: \$2,829. Zenon Technology Inc., City of Industry, CA; 800-899-6119, 818-935-1828; fax, 818-935-1826. Circle 485 on reader service card.



Vektron Home Office Pro-P150, ZDS Z-Station GT,
Zenon Dream Media P-166.

ware includes CoSession, Norton Anti-Virus, Norton Navigator, and Zenith's Recovery CD.

The Z-Station GT's 150-MHz Pentium processor was complemented by 256K of L2 cache and 16MB of on-board DRAM. Although our test system used a Diamond Stealth adapter, video is also integrated on the motherboard in the form of an ATI chip set and 2MB of VRAM.

On our benchmark tests, the Z-Station

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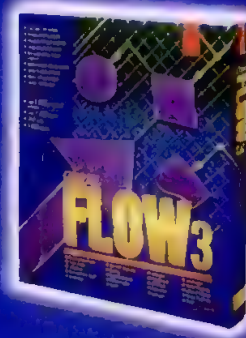
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WIRELESS LANs

Free to Roam

Wireless LANs let you stay connected to the network even

as you wander through the office from meeting to meeting. But how do these systems compare when you're considering price, management features, and performance?

By Padraic R. Boyle

When you think of wireless computing, you probably imagine sending and receiving e-mail while sitting on the beach, or connecting back to the office to see the current pricing of a product while you're on the road. Although switched cellular, CDPD, and other wide area wireless technologies can deliver such luxuries, those markets have been slow to take off mainly because of prohibitive costs, meager coverage, and in many cases, lack of standards. In the meantime, wireless LAN products, which let users retain a wireless connection to the network while roaming around a building or campus with a portable computing device, have begun a steady rise in sales because of improving performance, decreasing prices, and emerging standards. In 1994, revenues from wireless LAN products sold in the United States reached \$94.4 million, according to the Yankee Group, a Boston-based consulting and market research firm. Wireless LAN sales are expected to reach \$157.4 million by the end of 1995, and as high as \$725.4 million by 1998, according to the Yankee Group.

So far, wireless products have seen the majority of growth and profits in vertical markets such as retail stores, warehouses,



The Wireless Spectrum



What is it?	Wireless connections for peer-to-peer LANs or wireless connections to wired LANs using radio frequencies.	Wireless LAN connections using infrared light.	Wireless connection between two LANs.	Short messages transmitted wirelessly to alphanumeric pagers or PC Cards by paging-service provider.
LAN or wide-area communications?	LAN.	LAN.	Wide-area.	Wide-area.
Best used for...	Vertical LAN applications (such as medical or warehouse inventory) and executives who need constant network connections when running between meetings.	Vertical LAN applications (such as medical or warehouse inventory) and connecting clients in large open areas. Wireless printing and file transfer.	LAN connections over short distances.	Short text messages like alerts and e-mail.
How fast is it?	Up to 2 Mbps (claimed).	Up to 10 Mbps (claimed).	From 2 to 155 Mbps (claimed), depending on the product.	1.4 to 2.4 Kbps (claimed).
How much coverage is there?	Limited to LAN or campus if using wireless repeaters and bridges.	Limited to LAN or campus if using wireless repeaters and bridges.	Several hundred feet to 25 miles apart, depending on the product and conditions.	Nationwide.
What do I need to buy?	LAN adapter (usually PC Card) and antenna for each client; access point to attach to cabled LAN.	LAN adapter (usually PC Card) and antenna for each client; access point to attach to cabled LAN.	Two wireless bridges per connection.	Small pager device or PC Card pager and service.
Pros	Relatively fast wireless connection; can work through walls and supports roaming.	Faster throughput than spread-spectrum. Immune to interference from radio-frequency sources.	No cabling required; no monthly charges for T1 or ISDN line. Comparatively low capital cost.	Inexpensive way to transmit short text messages, and it can sometimes be used to transmit graphics. Good coverage. Two-way paging is on the way.
Cons	Expensive; no standards yet, and little interoperability among products. Vulnerable to interference.	Cannot penetrate walls. Shorter range than spread-spectrum. No standards or interoperability.	Distance limitations, especially in urban areas. Infrared bridges require line-of-sight configurations.	Not ideal for transmitting large files. Currently limited to one-way transmission.

and manufacturing plants, where salespeople and other workers roam around with pen-based portables and hand-held devices entering inventory or sale data into electronic forms or calling up data from the central database. You'll also find wireless pen-based portables making the rounds in hospitals and on trading floors. (See the sidebar "Wireless Hardware Finds a Niche.")

Today, wireless vendors are attempting to broaden their wireless product lines to include wireless adapters for notebook and desktop computers, opening the doors to a wider variety of vertical applications as well as the mainstream business user. And wireless products have come

down from about \$1,600 per adapter five years ago to \$399 today.

Wireless LANs can unchain business users from their desks, setting them free to roam the halls, floors, offices and conference rooms with their notebooks, all the while connected to the network and free to read and compose e-mail or access spreadsheets and databases.

WHAT MAKES A WIRELESS LAN

We tested nine wireless LAN products from Aironet Wireless Communications, AT&T Network Systems, BreezeCOM, Digital Equipment Corp., IBM Corp., Proxim, RDC Networks, Solectek Corp., and Xircom. All nine use spread-spec-

trum radio frequency technology, which spreads data throughput over a wide frequency. Symbol Technologies, another important wireless LAN vendor, chose not to participate.

There are two parts to a wireless LAN solution: the wireless client adapter and the access point. Each of the products we tested came with PC Card (formerly known as PCMCIA) adapters. In addition, Aironet, Digital, Proxim, RDC, and Solectek also offer ISA adapters for desktops and servers. And Solectek provides a parallel port version for those lacking PC Card slots.

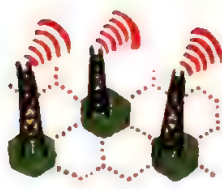
Wireless LAN is a little bit of a misnomer, because in the majority of cases

NETWORKING

Wireless LANs



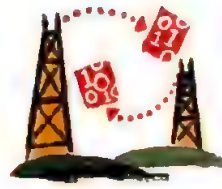
Enhanced specialized mobile radio



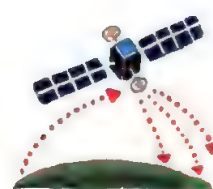
Circuit-switched cellular



Cellular digital packet data



Packet radio



Satellite

Paging-like technology that runs over mobile radio networks.	Data transmitted wirelessly to cellular base stations and then over public wired networks.	Digital data sent in packets over constantly changing idle channels of a cellular voice network.	Digital data sent in packets over radio using the X.25 protocol.	Data sent to low-orbiting satellites, which then transmit data to public networks.
Wide-area.	Wide-area.	Wide-area.	Wide-area.	Wide-area.
Short text messages. Voice transmission under development.	File transfers, faxes.	Short and bursty data such as e-mail messages, database queries, credit card authorization.	Short and bursty data such as e-mail messages, database queries, credit card authorization.	Fast file transfers.
4.8 Kbps (claimed).	Up to 14.4 Kbps (claimed).	Up to 19.2 Kbps (claimed).	Up to 19.2 Kbps, but it can be as low as 2 Kbps.	Up to 9.6 Kbps.
Selected states and metropolitan areas.	Nationwide over several cellular networks.	Selected cities and metropolitan areas.	Mostly metropolitan areas via Ardis and RAM Mobile Data networks.	Not yet deployed in the U.S.
Special hand-held ESMR devices and service.	Cellular modem (usually PC Card) and service.	CDPD modem (usually PC Card) and service.	Packet radio modem (usually PC Card) and service.	Not yet deployed in the U.S.
Will be able to integrate data and voice.	Wide coverage, decent throughput; standardized.	Based on TCP/IP. Fast and reliable; relatively inexpensive.	Reasonable pricing and coverage.	Fast; the user can expect excellent coverage.
Limited coverage; specialized devices.	Can be expensive and unstable.	Limited coverage.	Proprietary standards. Response time can be slow.	Not yet deployed in the U.S.

wireless LANs do not replace wired LANs. Instead they are used to create wireless extensions to wired LANs. To do this you need the second part of a wireless LAN, the access point. An access point is a stationary device that attaches to the wired LAN. An antenna links the wireless clients to the wired LAN via the access point.

Another, less common way to use wireless LANs is to set up an ad-hoc or peer-to-peer wireless network for meetings or training classes. If your needs are limited to transferring files wirelessly, you may want to look at a less costly solution—Traveling Software's LapLink Wireless with AirShare (\$299.95). LapLink Wireless connects to your serial port

and uses spread spectrum technology to transfer files between your notebook and desktop computers.

Wireless bridges from vendors such as Proxim, Soletek, and Windata have also been coming into the spotlight more and more as substitutions for dedicated links between campus-area networks (CAN). Wireless bridges eliminate the monthly charges incurred using a local telephone company and expensive equipment. And best of all, they offer speeds of up to 2 Mbps—faster than the 1.544-Mbps T1 wide-area transmission standard—at distances up to 25 miles.

Wireless LANs have significantly less bandwidth than wired LANs and should

thus not be thought of as a wired LAN replacement. The 1- to 2-Mbps throughput promised by many vendors is no match for the 10 Mbps or 100 Mbps wired LANs today. Moreover, the potential of interference from other electrical equipment limits wireless coverage and throughput. Nevertheless, if you run applications locally on your laptop, you'll find opening, manipulating, and saving files off the server perfectly comfortable, if a little slow, over a wireless LAN. Perhaps more important than performance results in our testing environment is how reliably the product performs in your own office environment, which may have different levels of usage and interference.

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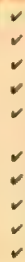
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Clean Sweep



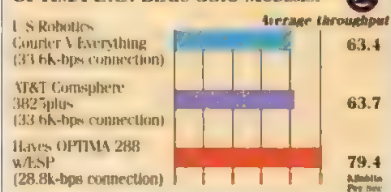
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CIRCLE 136 ON READER SERVICE CARD

THREE OF A KIND

Wireless LAN products are available in three different technologies—frequency-hopping spread-spectrum (FHSS), direct-sequencing spread-spectrum (DSSS), and infrared. FHSS and DSSS are spread-spectrum techniques that operate over the radio airwaves in the ISM (industrial, scientific, and medical) bands of the electromagnetic spectrum. The ISM band consists of the 902- to 928-MHz range and the 2.4- to 2.484-GHz range. Infrared operates between the visible part of the electromagnetic spectrum and the shortest microwaves. It comes in two forms: line of sight, which focuses the beam on a narrow path, and diffuse, which transmit light in a somewhat spherical pattern. We discuss infrared products in a sidebar (“Infrared Lights Up”) in this feature.

FHSS—represented here by the BreezeNET, IBM Wireless LAN Entry, Netwave, PortLAN, and RangeLAN2—uses a technique by which the signal transmitted hops among several frequencies at a specific rate and sequence as a way of

IN THIS REVIEW

Aironet Arlan.....	181	RDC PortLAN.....	200
AT&T WaveLAN.....	182	Solectek Airlan	203
BreezeCOM BreezeNET.....	186	Xircom Netwave	204
Digital RoamAbout.....	191	Editors' Choice	181
IBM Wireless LAN Entry.....	192	Performance Tests	200
Proxim RangeLAN2.....	196	Summary of Features	202

avoiding interference. Frequency hoppers are inherently smaller and cheaper to produce, as the case is with Xircom's Netwave PC Card adapter listing for \$399. And FHSS draws less power than DSSS. All the FHSS units we tested also allow the placement of multiple access points in a single area to allow users to share more bandwidth. Among the DSSS products—the Airlan, Arlan, RoamAbout, and WaveLAN—only Aironet's Arlan had this feature.

DSSS breaks data into small units called *chips* and uses a radio transmitter to spread the chips over a fixed range of the frequency band. DSSS costs more to manufacture than FHSS and uses more

power (1 watt versus 100 milliwatts). But all the FHSS and DSSS products we tested, except those from BreezeCOM and Xircom, provide some sort of sleep mode so the radios will not take up much battery life when not in use.

DSSS products win hands-down when it comes to raw throughput, averaging 1.2 Mbps on our NetBench tests with one client and one access point versus 0.34 Mbps for FHSS products. It was harder to draw conclusions from our distance tests, since conditions can change from moment to moment. Testing took place over two floors of a 33,000-square-foot building at our PC Labs test facility in Foster City, California.

HIGHLIGHTS

Wireless LANs

Don't think a wireless LAN liberates you from coils of cabling. These systems are designed to provide access to an existing LAN where running a wire is either impractical or impossible. For a user who must work everywhere in the office—and for other specialized needs—a wireless LAN can signal a solution for network managers.

Roaming is the visible advantage of implementing a wireless LAN. We've seen the products advance in the past year. In our previous roundup of these systems, only one allowed users to walk among access points and remain connected to the network. Now all of them provide roaming functionality, and we found that passing between access points was smooth in every case. Some of the products warn you when you've wandered out of range, and Xircom's Netwave even tricks NetWare into keeping connections open for wayward PCs.

Performance of every wireless solution is much slower than a wired LAN. The best of these systems will achieve close to 1.5-Mbps throughput; while this is much less than a wired network client, wireless users can comfortably perform tasks such as checking

e-mail and saving small documents. Much like remote-node dial up access, you will sit idle if you try to launch an application over the network.

The radio technology used by these systems falls into two categories: frequency-hopping spread-spectrum (FHSS) and direct-sequence spread-spectrum (DSSS). Each technique has its trade-offs: FHSS systems have poorer throughput, but they scale as you add access points, are less susceptible to interference, and use less client battery power. Most DSSS systems, while providing better throughput with one access point, do not take advantage of multiple access points with nonoverlapping frequencies.

Management of these wireless systems was not always easy, although most provide an SNMP agent. The better products provide several options to manage the access points and view statistics from anywhere on the network. Less glamorous systems require you to configure them using a serial port connection, and have limited options. Many systems required manual configuration on the client, although others had excellent installation routines as well as useful utilities that indicate the strength of a radio signal.

ROAM IF YOU WANT TO

One of the main benefits of spread-spectrum wireless LAN technology is roaming. Wireless LAN clients can roam the floors without dropping the connection. Once the client software notices a diminishing signal it searches the domain for the strongest access-point signal and connects to it. All of this happens transparently and seamlessly without losing connectivity to the file server. This year all nine products displayed roaming capabilities.

OTHER FACTORS TO CONSIDER

Aside from performance, security is an important issue that network managers should consider. FHSS products are tough to crack, though, because they are constantly hopping from one frequency to another in no particular pattern. DSSS may be slightly easier, since its signals can be deciphered by determining the spreading code. Keep in mind, however, that most of the products have multiple security features, including data encryption, data scrambling, and user IDs.

The IEEE committee has included both FHSS and DSSS techniques in its draft of the 802.11 wireless media access control (MAC) and physical (PHY) specifications.

Similar to other IEEE standards in place, the 802.11 specification should help bring down the pricing of wireless LAN products by replacing proprietary solutions with mass produced standard chip sets. Advanced Micro Devices recently introduced an 802.11 compatible media access controller chip called the PCnet-Mobile for wireless LAN devices. For those of you who can't wait for the standard to be completed, nearly all of the wireless vendors claim a migration path to the 802.11 standard. The final draft is expected to be finished by March of 1996. But the final ISO/IEC standard is not expected until early 1997.

SETUP CONSIDERATIONS

With the exception of products from AT&T, Proxim, and RDC, all of the vendors offer small, lightweight access points that can be easily mounted on a wall or above a ceiling panel. Smaller is not always the easiest way to go, though. Take into consideration that power and a network connection are required by an access point. If you mount them high, you may need to run unsightly cables up a wall. Proxim's and AT&T's access points, on the other hand, are larger than the others but offer long wire antennas allowing you to place the access point wherever you please.

Six of the access points in this review require a terminal connection through the serial port in order to configure them. This can be a hassle, especially when you have to travel to several access points. All of the products also offered an optional management information base (MIB) that works with any simple network management protocol (SNMP) platform such as HP's OpenView. AT&T, Proxim, and Xircom provide utilities that allow you to manage and configure any access point on the wired LAN. Four of the wireless LAN vendors provide a site survey tool that allows you to test signal quality, strength, and signal-to-noise ratio (SNR) to determine proper placement of access points.

Our Contributors: PADRAIC R. BOYLE, TONY POMPILI, and JOHN R. QUAIN are contributing editors of *PC Magazine*. FRANK J. DERFLER, JR., is senior networking editor and ROBERT P. LIPSCHUTZ is a technical director at *PC Magazine*. ANDREW GO is a support technician, ANATOLIY NOSOVITSKIY is an associate project leader, GREGORY SEWELL is a researcher, and TODD SPANGLER is a staff editor at *PC Magazine*. LEON ERLANGER was the senior associate editor in charge of this story, and JEFFREY G. WITT was the project leader.

Proxim RangeLAN2

In evaluating wireless LAN products, it's important to recognize that raw data throughput isn't everything. Despite variations in benchmark test results, we found the experience of using most of these products

to be equivalent. It was in installing, configuring, and managing wireless LANs that we found real differences that network managers should take into account.

Our Editors' Choice goes to Proxim's RangeLAN2. The best performer of the frequency-hopping spread-spectrum (FHSS) products, the RangeLAN2 came with a handy utility for configuring its access points from a central location on the network. AT&T and Xircom provide similar utilities, while other products required configuring each access point individually. The RangeLAN2 also comes with site survey tools to help you plan your wireless layout and diagnostic tools for troubleshooting problems.

Roaming with the RangeLAN2 was seamless and its coverage was among the best of the products we tested. And Proxim lets you configure as many as 15 individual access points in the same area, each operating under a different channel in nonoverlapping frequencies, to get optimum performance among several users.

Obviously, wireless LANs are not for everybody. They are still expensive, and there are no wireless-specific mainstream business applications available yet. But if your users need to be connected while roaming around the building, the extra cost and benefits outweigh the drawbacks.

HONORABLE MENTIONS

While we liked the RangeLAN2 the best, a few other products had features we found to be noteworthy.

The versatility award goes to the Digital RoamAbout, whose access point accepts PC Cards employing either FHSS or direct-sequence spread-spectrum (DSSS) technology. You can even use both in the same LAN if you want to purchase two different types of PC Cards for your access points.

We also liked the small rectangular antenna jutting out from the Xircom Netwave's wireless PC Card adapter—it was much easier to deal with than the separate antenna units of some other products. Xircom's installation and configuration were also a snap. Unfortunately, performance and range proved to be below average.

Finally, Aironet's Arlan was the only product that came with access points that could double as repeaters, extending the range of the network even farther than the other products. The Arlan also performed very well but installation was slightly problematic.



Aironet Inc.

Arlan



The Arlan system provides superb coverage and relatively good speed for roaming users. A unique feature is the access point's ability to act as a wireless repeater, which extends the system's range even farther from the wired network. But while the compact access point was simple to install, it was not easy to configure.

The Arlan 690 PCMCIA Wireless LAN Adapter (\$795) and Arlan 630 Wireless Ethernet Access Point (\$1,995) are direct-sequence spread-spectrum (DHSS) products that operate in the 2.4-GHz

frequency range. The antenna of the Arlan 690 adapter attaches to the lid of a laptop with an adhesive strip and is easy to remove. The Arlan 630 is small, lightweight, and can be mounted practically anywhere.

We ran into a small hurdle installing the client software. The installation program gave us a range of interrupt requests 2 through 9 to choose from, which we were already using on our test client. To access

more IRQs, we had to change the CONFIG.SYS file manually.

Arlan includes a DOS-based utility that configures the adapter and performs diagnostics, such as a link test

point, you can view each unit's total throughput. You see a snapshot of the data; the screen must be refreshed for the most recent information. A timer allows you to configure the amount of time in seconds between updates of the statistics screen.

Once operational, the Arlan system performed very well on our tests, with the best throughput on our test with two access points and multiple clients. Roaming worked fine, but the transfer between access points was somewhat jittery. Unique among the DSSS products, Arlan lets you place a maximum of three access points next to each other without causing interference. But you must assign a wireless client to a specific access point; the load balancing is not automatic. Each client uses a predefined frequency range and access point.

The Arlan 630 access point can operate as a wireless repeater, a feature not available in any other wireless product in this roundup. This allows you to extend the wireless network range from an access point that is connected to the wired network. A second access point, positioned within range of the first, transparently routes client connections that are out of range of the first access point.

Covering a wide spectrum of wireless products, Aironet is the only vendor in our roundup to offer a wireless Token-Ring solution. The Arlan 631 Token-Ring Access Point (\$2,795) uses the same client adapters as the Ethernet access point. In addition to MCA and ISA client Ethernet and Token-Ring adapters, Aironet offers versions of its 690 adapter and 630 access point that operate in the 902-MHz band, which were not tested in this review.

—Padraic R. Boyle

Arlan. List price: Arlan 690 PCMCIA Wireless LAN Adapter, \$795; Arlan 630 Wireless Ethernet Access Point, \$1,995. Aironet Wireless Communications Inc., 367 Ghent Rd., # 300, Fairlawn, OH 44334; 800-394-7353, 216-665-7900; fax, 216-665-7922. *Circle 490 on reader service card.*

AT&T Network Systems

WaveLAN

Although AT&T's WaveLAN produced some of the best overall results on our tests, it had one of the most arduous installation routines we saw in this roundup.

The WaveLAN system includes a PC Card client adapter (\$695), WavePoint access point (\$1,995), and WaveAround software that allows roaming among access points. Operating in the 902-MHz band using direct-sequence spread-spectrum (DHSS) transmission, the WavePoint access point is a slim unit that hooks up to a LAN via either a 10Base-T or 10Base2 connection. A small antenna, about the size of a deck of cards, attaches to the access point via a cable, allowing you to place it above the access point for better transmission.

Each WaveLAN adapter is a Type II

SUITABILITY TO TASK

Arlan

Installation and configuration	Fair
Management and administration	Good
Mobile usability	Good

SUITABILITY TO TASK

WaveLAN

Installation and configuration	Poor
Management and administration	Fair
Mobile usability	Good



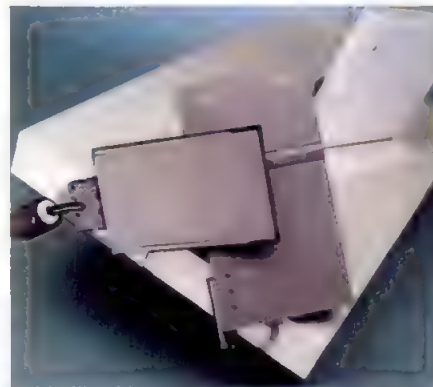
Aironet's lightweight Arlan 630-2400B access point can be mounted almost anywhere.

that determines the link quality either between two clients or between a client and an access point. Like Proxim's utility, the diagnostics are somewhat useful for determining access-point placement.

GET TO THE POINT

Installation of the access point was easy: We plugged the access point into the network, and it autodetected the frame type and configured itself accordingly. But configuring the Arlan access point was not as easy as installing it. You connect to the 630 Access Point through its RS-232 port using communications software (such as Windows Terminal). Text-based menu screens guide you through configuration. Arlan's security consists of a registration table of up to 2,048 entries. You can also set up the system with the SNMP MIB for Arlan's access point, available from Aironet's BBS, with an SNMP management package.

In addition to configuring the access



The antenna for AT&T's WavePoint access point can be positioned above it for better coverage.

PC Card connected to an antenna. The antenna can be attached to the notebook with an adhesive bracket, but once hooked up in this manner its transmit and receive LEDs are difficult to see.

CHAOTIC CONFIGURATION

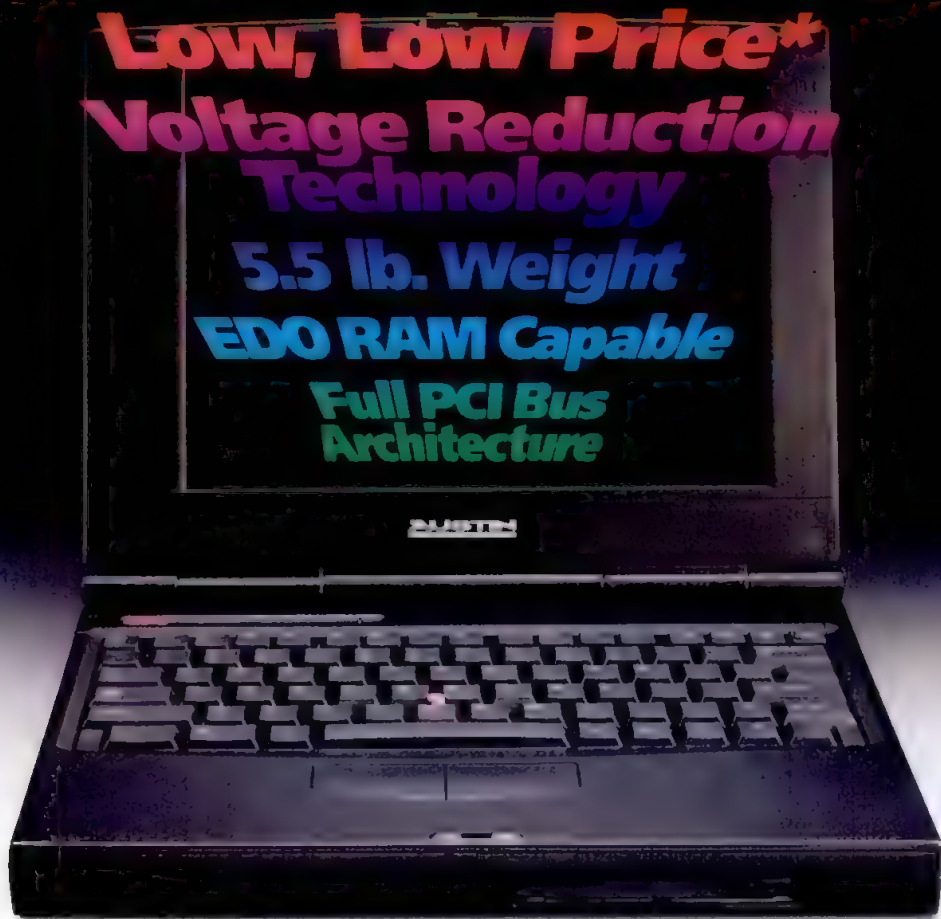
To set up a WavePoint, you must configure the software from a client already wired to your LAN. We found the setup unnecessarily complex, and the documentation ambiguous. At several points, for example, you must edit PROTOCOL.INI and make other manual adjustments. With these time-consuming procedures it's easy to make a misstep—which we did while installing the necessary NDIS driver.

Client configuration was smoother, and the WaveLAN PC Card is Plug and Play-compliant for Windows 95. Although WaveLAN does not include a comprehensive site-survey tool to determine access-point placement, AT&T's WaveMonitor

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- 16-Bit Audio Card, Stereo Speakers
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PC Magazine, Editor's Choice Awards, May 30, 1995 Issue



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2 Type II or 1 Type III PCMCIA Slots
Parallel, Serial, Keyboard, IRDA, SVGA Ports
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Weight with Battery: 5.5 lbs.
One-Year Parts & Labor Warranty
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Parallel, Serial, Keyboard, IRDA, SVGA Ports
Weight with Battery: 5.5 lbs.
One-Year Parts & Labor Warranty
Win '95 Plug n' Play BIOS
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- 75MHz Intel Pentium Processor
- 10.4" DSTN Color Display
- 8MB RAM (expandable to 24MB)
- 814MB Hard Drive (Fast IDE Interface)
- 32-Bit PCI Video - 1MB
- Internal 3.5" Diskette Drive (Removable for optional second battery)
- Business Lease: \$94 / month

AUSTIN EDGE XL
486DX4-100 \$2,071

- 100MHz Intel 486 DX4 Processor
- 10.4" DSTN Color Display
- 8MB RAM (expandable to 20MB)
- 543MB Hard Drive
- Internal 3.5" Diskette Drive (Removable for optional second battery)
- Business Lease: \$79 / month

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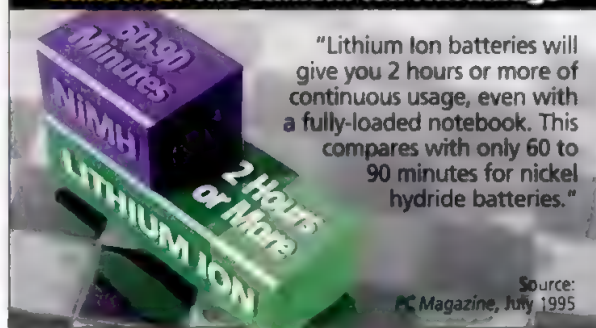


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It's no secret that Lithium Ion technology makes notebook batteries last longer. But until now it was just too expensive. Austin makes Lithium Ion technology affordable. And builds it into a notebook that is priced to stand up to even the most intense comparison shopping.

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"Lithium Ion batteries will give you 2 hours or more of continuous usage, even with a fully-loaded notebook. This compares with only 60 to 90 minutes for nickel hydride batteries."

Source: PC Magazine, July 1995

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CIRCLE 012 ON READER SERVICE CARD

Wireless Hardware Finds a Niche

By Robert P. Lipschutz

Roaming the halls with your laptop isn't the only way to take advantage of wireless networks. Much of the wireless computing market consists of personal digital assistants (PDAs) and pen-based portables that incorporate both local- and wide-area wireless technologies to serve specialized markets. PDAs with PC Card slots can fit in your pocket and be taken on the road to send and receive faxes and e-mail over wide-area wireless networks.

Many pen-based computers use wireless technologies and forms applications to serve niche markets like health care, hospital-ty services, package and parcel delivery, and warehousing.

Doctors and nurses, for example, can use wireless pen-based computers to enter patient data into electronic charts throughout the hospital. A pen-based laptop or specialized touch-screen device facilitates faster and more accurate information gathering for hospitality services and retail businesses. And in warehouses, bar code readers equipped with wireless adapters make taking physical inventory less painful.

As your company ventures into wireless, some of the products listed in the table below may be just what you've been looking for. Pen-based

systems generally run Microsoft's Windows for Pen Computing and use specialized forms applications.



Left to right: the HP 200LX palmtop PC, Toshiba's Dynapad 200, and Sony's Magic Link PIC-2000.

Get the Right Device

For those whose needs go beyond a laptop linked to a LAN, here's a sample of other wireless products to consider.

Company	Phone	Product	List price	Description	Dimensions (HWD)	What it's best for
Fujitsu Personal Systems Inc.	800-831-3183	Stylistic RF	\$3,995 (170MB hard disk)	486 pen-based computer with Proxim's RangeLAN2 wireless LAN adapter	1.5" x 10.5" x 7.0"	Mobile LAN users who need a hand-held device
Hewlett-Packard Co.	800-443-1254	HP 200LX	\$699 (2MB RAM)	Palmtop PC that includes business applications, PC Card slot, keyboard, and infrared port; optional wireless modem	1.0" x 6.0" x 3.5"	Traveling users who need a portable PC with connectivity options
LXE Inc.	770-447-4224	LXE ST 500	\$3,995 (170MB hard disk)	Fujitsu's 486 pen-based computer with Proxim's RangeLAN2 wireless LAN adapter	1.5" x 10.5" x 7.0"	Mobile LAN users who need a hand-held device
Sony Electronics	800-556-2442	Magic Link PIC-2000	\$899	Pen-based PDA with 2 PC Card slots and 14.4-Kbps modem; optional wireless adapter for most cellular phones	1.5" x 7.5" x 5.5"	Traveling users who need a portable PC with connectivity options
Symbol Technologies Inc.	800-722-6234	Symbol PPT 4600	\$4,700 (half-screen)	486 pen-based computer with Symbol's wireless LAN adapter built-in; optional bar-code scanner	3.5" x 6.0" x 10.0" (half-screen)	Mobile LAN users collecting industrial and commercial data
Toshiba America Information Systems Inc.	800-334-3445	Dynapad T200	\$1,850	486 pen-based computer with 2 PC Card slots	1.5" x 8.0" x 10.5"	Mobile LAN users who need a hand-held device
Zenith Data Systems	800-533-0331	CruisePAD	\$1,399	Pen tablet device with Proxim's RangeLAN2 wireless LAN adapter built-in and remote-control software for accessing a desktop PC	1.0" x 10.5" x 10.0"	Mobile users accessing a desktop PC while roaming in an office

software indicates the strength of the signal between an access point and a client.

Once you've negotiated AT&T's installation, an included utility allows you to set domain addresses, enter the network ID name, and toggle encryption and roaming. The utility, which you load from a boot disk, lets you change these parameters from any client on the LAN (including the wireless clients) without having to use awkward console controls or visit each access point. For SNMP, AT&T also supplies MIBs with the WavePoint.

On our tests, roaming from one access point to another proved seamless, with

minimal delays when switching from one access point to another. Once you stray beyond the coverage area and the connection has been dropped, WaveLAN gives you no special notification, although it automatically reconnects if you return within range before the network times you out.

In terms of straight throughput, AT&T's WaveLAN had the best performance on our multiple-client NetBench test with one access point, delivering more than 1.4-Mbps throughput with six clients. On the other tests, the WaveLAN generally matched the other DSSS products.—*John R. Quain*

WaveLAN. List price: PC Card adapter, \$695; WavePoint, \$1,995. AT&T Network Systems, 111 Madison Ave., Morristown, NJ 07960; 800-344-0223, 314-536-1886; fax, 314-891-6542; <http://www.attgis.com>. Circle 491 on reader service card.

BreezeCOM

BreezeNET

The BreezeNET system is certainly a light package: Not only does it have the smallest access point in our roundup, it also has the least expensive access point and adapter. But it's also

Gateway 2000



Portable PCs



Aurora borealis. The perfect excuse to get away.

Made sure the battery
on my Gateway Solo™
S5-120XL multimedia

notebook was charged, fueled up the truck
and headed north. Second quarter
projections could wait.

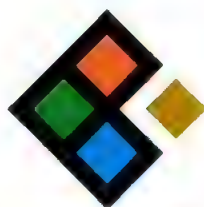
I watched Mother Nature's display
dance across the northern sky. And life just
seemed to make sense. Looking at my Gateway

Solo S5-120XL multimedia notebook I thought, this machine
also makes perfect sense. Think of it. A powerful 120MHz
Intel® Pentium® processor, active matrix SVGA color display,
40MB RAM, whopping 1.2GB hard drive, and CD-ROM drive.
All the power of a high-end multimedia desktop in a portable
package. Who needs more?

A German opera filled the night.

I was deep in thought. Thanks to the swappable CD-ROM
drive and integrated speakers, features found on all models of the
Gateway Solo
multimedia
notebook line, my
favorite German opera
filled the night.

Suddenly I heard hoofbeats.



GATEWAY2000
S O L O

Turning I found myself face to chest with a large
white horse.

"Hello madam,"
said the uniformed
man atop the horse.



"Is that a Gateway 2000 portable?"

What a coincidence, I have one too!"

Desktop power that fits on a horse.

He reached into his pack and pulled out a Gateway Solo S5-75XL
notebook. "My S5-75XL is loaded with a 75MHz Pentium
processor, 8MB RAM, and 540MB hard drive. With the 16-bit
sound, stereo
speakers and a
CD-ROM
drive, I can use multi-
media applications anywhere.

Even in the boondocks. And
the active matrix color display provides a great view."

This value-packed system is ideal for the professional person on
the go such as myself. And the best part, it fits on a horse," he said
with a smile. "Gateway 2000® is the place to go for great values on
portable PCs. And while you can compute anywhere, I must ask



*EZ Pad™ pointing
device for easy cursor
navigation.*

you to cease and desist." I gave him a
questioning look. He continued, "It's
mating season for many of our furry friends
and we wouldn't want the glow from your

**More cc
more**

active matrix color display ruining their plans. Thank you madam and enjoy your evening." And with a tip of his hat, off he rode.

My commune with nature over, I found an offbeat diner and stopped in for some food. I felt someone watching me. As I scanned the room, our eyes met.

He was sitting at the counter, a Gateway Liberty™ small

notebook in front of him. He looked vaguely familiar. I pointed to my portable

and mouthed, "Gateway 2000." He smiled and gave me a



thumbs up. "My Gateway

computing, places.

Liberty small notebook is way

cool," he said, pulling up a chair. "Powerful and light-weight, man. It's just what I need. I'm a poet now. But I used to have a band."



Gateway Solo notebooks are optimized for Microsoft® Windows® 95.

A band!

Memories of him in a silver jumpsuit and platform shoes came flooding back! He'd been plastered all over

I'm telling you, Gateway is just great!



Models from the Gateway Solo multimedia line have a modular CD-ROM drive.

my bedroom walls for years.

"I'm telling you, Gateway 2000 really takes care of their customers. I can get telephone

technical support anytime. And

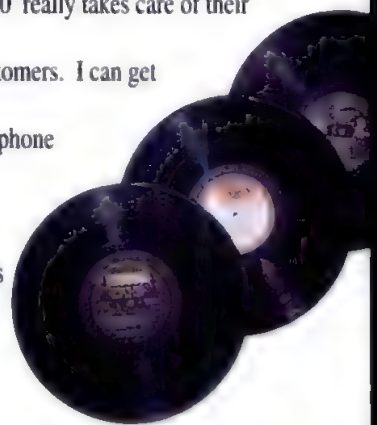
Gateway's values are just out of this

world. Hey, you wanna come over

to my place and listen to some

vinyl?" I had a feeling my adventures were just beginning.

For more computing, more places — call Gateway 2000 today.



GATEWAY2000

"You've got a friend in the business."

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**SS-75XL**

- 10.2" VGA Color Display
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- Parallel, Serial, Infrared, VGA & PS/2® Ports
- Built-In Mic, Headphone and Line-In Jacks and External Volume Control Dial
- 11.8" x 8.8" x 2.0"
- Microsoft® Windows® 95™
- MS Works 95
- Carrying Case

\$3299**SS-90XL BEST BUY**

- 10.2" VGA Color Display
- 90MHz Intel Pentium Processor
- 8MB RAM (expandable to 40MB)
- 256K L2 Pipelined Burst Cache
- 540MB Hard Drive
- Modular 2X CD-ROM Drive
- 3.5" Modular Floppy Drive
- Integrated 16-Bit Sound with Stereo Speakers
- 1MB Video RAM
- Lithium Ion Battery & AC Pack
- EZ Pad Pointing Device
- 86-Key MS Windows 95 Keyboard
- Parallel, Serial, Infrared, VGA & PS/2 Ports
- Built-In Mic, Headphone and Line-In Jacks and External Volume Control Dial
- 11.8" x 8.8" x 2.0"
- Microsoft Windows 95™
- MS Office 95, Professional Edition†
- Carrying Case

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- 10.4" SVGA Color Display
- 90MHz Intel Pentium Processor
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- 256K L2 Pipelined Burst Cache
- 1.2GB Hard Drive
- Modular 2X CD-ROM Drive
- 3.5" Modular Floppy Drive
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- 1MB Video RAM
- Lithium Ion Battery & AC Pack
- EZ Pad Pointing Device
- 86-Key MS Windows 95 Keyboard
- Parallel, Serial, Infrared, VGA & PS/2 Ports
- Built-In Mic, Headphone and Line-In Jacks and External Volume Control Dial
- 11.8" x 8.8" x 2.0"
- Microsoft Windows 95™
- MS Office 95, Professional Edition†
- Carrying Case

\$4599**SS-120XL**

- 10.4" SVGA Color Display
- 120MHz Intel Pentium Processor
- 40MB RAM
- 256K L2 Pipelined Burst Cache
- 1.2GB Hard Drive
- Modular 2X CD-ROM Drive
- 3.5" Modular Floppy Drive
- Integrated 16-Bit Sound with Stereo Speakers
- 1MB Video RAM
- Lithium Ion Battery & AC Pack
- 28.8 PCMCIA Fax/Modem
- EZ Pad Pointing Device
- 86-Key MS Windows 95 Keyboard
- Parallel, Serial, Infrared, VGA & PS/2 Ports
- Built-In Mic, Headphone and Line-In Jacks and External Volume Control Dial
- 11.8" x 8.8" x 2.0"
- Microsoft Windows 95™
- MS Office 95, Professional Edition†
- Deluxe Leather Carrying Case

\$5899**GATEWAY LIBERTY™ DX4-100**

- 10.4" SVGA (800 x 600) DSTN Color Display
- Intel 486DX4-100 Processor
- 4.2 Lbs., 10" x 8" x 1.6"
- 8MB RAM (expandable to 24MB)
- 340MB Hard Drive
- 1MB Video RAM
- External Floppy Drive
- NiMH Battery & AC Pack
- 2 PCMCIA Type II Slots, or 1 Type III Slot
- EZ Point® Integrated Pointer
- 78-Key Keyboard
- Parallel, Serial, VGA & PS/2 Ports
- Microsoft Windows 95 on diskette™
- MS Works 95 on diskette
- Ascend® personal information manager (for use with Franklin Day Planner®)

\$2399

**MS-DOS® 6.22 and MS Windows for Workgroups 3.11 available upon request.

†MS Office 95, Professional Edition includes Word, Excel, PowerPoint® presentation graphics program, Schedule+, MS Access® database and Bookshelf® 95.

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NETWORKING

Wireless LANs

light on features, with limited configurability and only a 10Base-T connection.

As tested, BreezeNET consists of BreezeCOM's access point, the AP-10X-A (\$1,295), and the SA-PX-A client PC Card

adapter (\$395), which is licensed from Xircom. Similarly, Digital provides its own access point but licenses adapters from AT&T and Proxim. As it's built around Xircom's

it as part of the roundup, because it requires an external power supply, making the SA-10 unsuitable for roaming PCs.

The BreezeNET access point's main advantage is its compact size. It sports dual antennae to help minimize black holes in the coverage area that can disrupt radio signals between access points and clients. Sacrificed in BreezeCOM's efforts to miniaturize the access point was a BNC connector, so the AP-10X-A only supports a 10Base-T Ethernet connection through an RJ-45 port.

NOT QUITE A BREEZE

Setting up the BreezeCOM AP-10X-A was simple but cumbersome. You must configure it through a serial-port connection and communications software (such as Windows Terminal). Because of the AP-10X-A's size, you also must use BreezeCOM's flimsy, proprietary serial cable. The AP-10X-A includes an SNMP agent, and BreezeCOM should have a MIB available by the time you read this.

The menu-based configuration software allows you to set up the AP-10X-A's basic parameters such as hopping sequence and network ID (a unique name given to each access point). We would have liked more documentation on the setup and configuration options. Also, we discovered a small bug: We couldn't set the access point for even-numbered hopping sequences. BreezeCOM says the problem will be fixed

by the time you read this.

The client side of BreezeNET is purely Xircom—a smart move, because Xircom has some of the best utilities for setup and configuration, site survey, and signal-quality testing. Unlike Xircom, though, BreezeCOM's access point does not have a NetWare spoofing feature, which keeps network connections active for an extended period of time if users drift out of range.

On our roaming tests we found that moving between access points was nearly instantaneous. On our benchmark tests, BreezeNET placed in the middle of the other FHSS systems tested.

BreezeNET is a lightweight, inexpensive wireless solution with very simple configuration software. If its compact size appeals to you and your wireless LAN needs are basic, BreezeNET is worth considering.—*Tony Pompili*

BreezeNET. List price: SA-PX-A, \$395; AP-10X-A, \$1,295. BreezeCOM, 2195 Faraday Ave., Suite A, Carlsbad, CA 92008; 619-431-9880; fax, 619-431-2595. Circle 492 on reader service card.



The low-cost BreezeNET had the smallest access point we saw; however, it was somewhat cumbersome to set up and configure.

Netware, BreezeNET uses frequency-hopping spread-spectrum (FHSS) transmission in the 2.4-GHz band. BreezeCOM does offer its own adapter, the SA-10, for the BreezeNET system. But we didn't include

Digital Equipment Corp.

RoamAbout

More than any other product we reviewed, RoamAbout excels in flexibility. A PC Card slot in the RoamAbout Access Point works with either Proxim's RangeLAN2, which employs

WIRELESS LANs

How to Read the Suitability to Task Boxes

While users want wireless LAN products in order to roam untethered by the wired LAN, administrators want products that are easy to implement and manage. We rate each wireless LAN system based on three criteria: installation and configuration; management and administration; and mobile usability.

We want easy-to-follow **installation and configuration** via simple menu-driven or graphical utilities. We look for Card and Socket

Services compliance for client PC Card adapters and in-band network setup of the access points. We also look for useful site-survey tools to determine access point placement and connection quality. We expect every product to connect to a server running NetWare 3.12 or Microsoft Windows NT 3.51 Server, and to operate in a peer-to-peer environment with Windows for Workgroups.

Like any network device, wireless LANs require on-going **management and administration**. We prefer software that works in-band from anywhere on the

SUITABILITY TO TASK

Product Name

Installation and configuration	Poor
Management and administration	Fair
Mobile usability	Good

network and contains intuitive step-by-step procedures for organizing domains and controlling users. We give high marks to products that offer security options such as data encryption or the ability to limit access to specific domains or users. Reliability is always a factor, and we favor products that include easy-to-use diagnostics for troubleshooting and analyzing troublesome connections. We also look for the ability to filter network traffic by protocol or MAC address.

A product's **mobile usability** is a measure of its functionality and practicality. We rate how the system affects the existing environment and a user's typical network connectivity. We score roaming and distance based on how well each product passes off the connection among access points, and the ability of a user to stay connected after leaving and then re-entering the area of coverage. Products that notify the user of connection status received better scores. We give higher ratings to products that include power-management utilities.

frequency-hopping spread-spectrum (FHSS), or AT&T's WaveLAN, which uses direct-sequence spread-spectrum (DHSS) transmission. Better client software and more accessible management features would make this well-priced, flexible solution even more attractive.

You can purchase the client adapters from either Digital or the original manufacturer. The RoamAbout 915 DS/PC Card—the model we tested—and the 2400 DS/PC Card adapters are identical to AT&T's 915-MHz and 2.4-GHz WaveLAN adapters. Likewise, Digital's 2400 FH/PC Card adapter is Proxim's RangeLAN2 adapter. To use FHSS and DHSS simultaneously, you can set up separate access points for each transmission type. Each adapter's radio and antenna assembly mounts to your notebook with a self-adhesive bracket.

RoamAbout is designed to be an extension to Digital's line of networking products. The access point fits into the DEChub 90/900 and works with Digital's stackable-hub products. Digital, a familiar name in the bridging arena, uses technology based on its high-speed FDDI bridges to improve performance in the RoamAbout access point. The RoamAbout's performance was well above average, with some of the best throughput of any of the products tested.

BACK-DOOR SETUP

The access point can be configured and managed via a serial-port terminal connection or from an SNMP station. The terminal management option, however, gives you just a subset of management features available through SNMP. For example, you can't use the terminal to configure many of the more detailed filtering techniques, such as MAC address filtering. We would like to have seen some IPX-based Windows software familiar to many PC network administrators.

On the client, setup and installation of the RoamAbout 915 DS/PC Card was passable but should have been smoother. To create a RoamAbout client, we had to enter each client's network configuration (such as domain and network ID). Then, after inserting the adapter into the client's PC Card slot, the configuration is loaded into the adapter's flash ROM. The client software, licensed from AT&T, is adequate

but pales next to Xircom's more automated installation and configuration.

As with most of the products in this

SUITABILITY TO TASK

RoamAbout

Installation and configuration	Good
Management and administration	Fair
Mobile usability	Good

roundup, roaming with RoamAbout was quick and effortless. Although not specifically a site-survey tool, the Point-to-Point Diagnostics program



The RoamAbout access point is designed to fit into Digital's line of stackable-hub products.

checks link quality between the client and access points or other radio-equipped notebooks. The DHSS version of RoamAbout also comes with AT&T's WaveMonitor site survey tool.

Digital's mix-and-match approach to building a wireless LAN allows network administrators to pick the radio technology while using the same RoamAbout Access Point. While easier installation and more convenient access to management options would improve RoamAbout, the system is a powerful wireless LAN solution.—*TP RoamAbout*. List price: RoamAbout 915 DS/PC Card, \$695; RoamAbout Access Point, \$1,795. Digital Equipment Corp., 5 Littleton Rd., Westford, MA 01886; 800-457-8211, 508-692-2562; fax, 508-392-0603; <http://www.networks.digital.com>. Circle 493 on reader service card.

IBM Corp.

IBM Wireless LAN Entry

With an elegant hardware design, the IBM Wireless LAN Entry offers one of the lowest-cost solutions in this roundup. Unfortunately, the system, which includes the 8227 Wireless LAN Entry Access Point (\$1,350 for the internal

antenna version) and client adapter (\$445), is tied down by an arduous installation process and lackluster performance.

A frequency-hopping spread-spectrum (FHSS) product, the IBM operates in the 2.4-GHz band and hooks up to a LAN via a 10Base-T or AUI connection. Each access point includes a PC Card adapter with a small, built-in antenna that you insert into the access point, similar to Xircom's Netwave. (An access point with an external antenna is available for \$1,425.) The package includes mounting brackets and extensive instructions on how to set up a wireless LAN; however, it includes no site survey tool to test signal quality.

The client adapter, a PC Card with a small antenna that juts out about 2 inches from the side of the card, offers a tidy solution. The adapter is Plug and Play-compatible, and LEDs on the card indicate when transmissions are under way. Each IBM Wireless LAN Entry adapter includes LANtastic 6.0 software, enabling you to connect to just about any NOS.

Setting up the IBM Wireless LAN Entry system, while not as frustrating as setting up AT&T's WaveLAN, was awkward nonetheless. Much of the software adjustments must be made manually, including adding statements into the AUTOEXEC.BAT file—a process that is usually handled by an automated installation routine.

SET UP TO BOOT

To configure the access point, you create a remote-boot image on the server; the access points don't have internal drives. This allows you to reconfigure access points without having to go to each location. When you want to set up or change settings, you adjust entries in the remote boot disk's configuration files. You can change basic settings such as the network identifier and authorization number to restrict access. In addition, an SNMP agent and MIB are available from IBM's BBS.

On roaming tests, we seamlessly moved between access points. Like most of the wireless LANs we tested, no specific message alerts you when you wander out of range, although the LEDs on the PC Card's antenna indicate that no traffic is being received. You reconnect to the LAN simply by walking back into range.

The system's performance tended to



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\$319



\$325



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CIRCLE 211 ON READER SERVICE CARD

Infrared Lights Up

By Frank J. Derfler, Jr.

The focus of our main review is on radio systems, but there is another wireless alternative for those out of cable range: using infrared light. Like the radio side, infrared (IR) comes with its own set of standards, applications, and limitations.

The applications for IR fall into two distinct areas: short-distance links to peripherals, and LAN (or even inter-LAN) connections. Both need a line-of-sight path for communications, but each has its own advantages. Overall, IR connections are very secure and don't generate much interference.

SHORT DISTANCE LINKS

These light links connect notebooks to printers, desktop computers, hand-held organizers, and even to cellular telephones. Lexmark International's (800-891-0331) MarkNet IR adapter, \$279, connects to the parallel port on a printer or desktop PC. Adaptec's (800-959-7274) AIRport 2500, \$189, includes both a desktop and a laptop IR adapter. Hewlett-Packard (800-752-0900) and other companies have IR-enabled printers, such as the HP LaserJet 5MP (\$1,299) and the portable HP DeskJet 340 (\$365). These systems generally have a maximum useful range of 4 to 6 feet and an effective throughput from 50 Kbps to about 100 Kbps.

You should make sure that any IR-equipped product you buy conforms to the standard issued by the Infrared Data Association (IrDA). Drivers for IrDA products are not included with Windows 95, but Microsoft recently made them available. You can download the Windows 95 IrDA drivers at <http://www.windows.microsoft.com> or from online services.

LIGHT LAN

It would seem that the line-of-sight limitations on IR products would limit their ability to act as a LAN carrier, but if you consider the low dividers used in many offices, the openness of a warehouse, or the open spaces between buildings, you see the opportunities.

Photonics (800-997-2326) is the

The Infrared LAN

Although infrared needs a direct line of sight between transceivers, you can connect stationary users in an open environment by setting up multiple paths and bouncing signals off of walls

IR transceiver

Access point

IR transceiver

leading company in the optical LAN market. Photonics' Collaborative family of products includes: a PC Card adapter with an external transceiver (\$249); a PC Card with an embedded transceiver (\$299); a parallel-port adapter (\$229), and an 8-bit ISA card (\$199). The \$349 EtherPoint access point is a complete box ready to plug in, but you can also purchase the software for \$99 and the ISA transceiver to retrofit a PC as an access point.

The Collaborative system operates using diffuse IR, bouncing light off ceilings and walls. The palm-size optical transceivers can sit on top of monitors, bookshelves, or dividers. The idea

is to adjust the optical transceivers to set up multiple paths so that a person walking by doesn't disrupt the signal.

The Photonics products use a 1-Mbps signaling rate, and in our testing we saw throughput of around 700 Kbps for a single unit. According to the specifications, the system operates in a room 25 feet by 25 feet, with some variation depending on your environ-

ment. We tested the system in a room of those dimensions flooded with sunlight and had no problems.

Spectrix Corp. (800-710-1805) markets a product called SpectrixLite that fits applications for a large number of users. The system can carry a large number of clients with little degradation, suitable for sites such as theaters or stock exchange trading pits.

CommLink client adapters, available in PC Card and serial-port versions, retail for \$495 and access points start at about \$4,000. SpectrixLite signals at 4 Mbps, but the CommLink adapters' maximum speed is typically 38.4 Kbps.

A.T. Schindler Communications (613-723-1103) mar-

kets an IR product line called FiRLAN that contrasts with the Photonics and Spectrix products. FiRLAN's main strength is LAN-to-LAN connections across both indoor and outdoor open spaces for Ethernet or Token-Ring networks. Each transceiver transmits data at full LAN speed on a tightly collimated beam of light. The company sells models with different ranges up to 1,500 feet, but they are practical for distances between 30 and 500 feet. The products start at about \$3,200 for a pair of transceivers with a 110-foot range. Because the devices are repeaters, you can set them up back-to-back, within the limits of the network rules, to extend the distances.

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CIRCLE 117 ON READER SERVICE CARD

lag compared with that of the other systems. IBM Wireless LAN Entry was the lowest performer on almost every test. It also did not scale well, delivering a last-place 0.16-Mbps throughput with six users attached to a single access point.

IBM's thorough documentation will prove helpful to anyone setting up a wire-

less solution for the first time. The installation is not nearly as automated as it should be, and performance is less than optimal, but the Wireless LAN Entry may

and RangeLAN2 7500 Access Point (\$1,895) also showed the best overall performance of the frequency-hopping spread-spectrum (FHSS) products tested. Similar to most of the other products in this review, the RangeLAN2 client PC Card adapter has an antenna connected via a cable. The slim antenna secures to the lid of the laptop computer with an adhesive strip and is easy to remove. The client drivers, which require a hefty 53K of RAM loaded in DOS, are copied during the installation process. Proxim should have a Windows 95 driver available by the time you read this.

Proxim's access point looks like a small-footprint PC and includes a 3.5-inch floppy disk drive, two ISA slots, and an RS-232 port. The first ISA slot has an Ethernet adapter, and the other a wireless adapter to which you attach a 6-inch antenna via a cable. This design allows you to place the access point near a power outlet and Ethernet connection and mount the antenna higher up for better coverage. Proxim also sells longer antennas for wider coverage. Xircom, by contrast, offers a smaller access point (without an external antenna) that can be mounted on a wall.

in close proximity to a server, Proxim offers the option of installing an ISA-based wireless adapter (\$595) into a NetWare server. The server then acts as the access point, saving the cost of an extra access point. Server drivers for Windows NT Server and OS/2 were in beta at the time of this review; both should be available by the time you read this.

Proxim supplies a set of tools to assist in the layout and diagnostics of your wireless LAN. The Site Survey utility reports signal strength and

SUITABILITY TO TASK

IBM Wireless LAN Entry

Installation and configuration **Poor**

Management and administration **Fair**

Mobile usability **Fair**

less solution for the first time. The installation is not nearly as automated as it should be, and performance is less than optimal, but the Wireless LAN Entry may



IBM Wireless LAN Entry uses the same client PC Card (with a built-in antenna) in its access point.

appeal to network managers seeking a relatively inexpensive roaming solution.—*JRQ*

IBM Wireless LAN Entry. List price: Wireless LAN Entry adapter, \$445; 8227 Wireless LAN Entry Access Point, internal antenna version, \$1,350. IBM Corp., 700 Park Office Dr., Bldg. 662, Research Triangle Park, NC 27709; 800-426-2968; fax-back, 800-772-2227; <http://www.raleigh.ibm.com>. Circle 494 on reader service card.

Proxim Inc.

RangeLAN2



Excellent range, a single point of management, and some of the most extensive configuration tools in this roundup make RangeLAN2 a good choice for keeping roaming clients connected to the LAN.

Proxim's system, which includes the RangeLAN2 7200 PC Card adapter (\$695)

FAR AND WIDE

The access points boot from floppy disks, but once operational, they can be configured centrally via an included configuration utility. You can access Proxim's DOS-based utility from any network client and configure filters based on protocols and unwanted broadcast packets such as Service Advertisement Protocol (SAP) traffic. The utility also lets you reboot access points anywhere on the network.

Using a master/slave method, RangeLAN2 controls the frequency hopping of connected clients with predefined frequency "channels." As many as 15 channels can be configured in a single wireless LAN. This means that you can place multiple access points—each operating on a different channel—in the same area without causing interference with each other. The access points are generally the masters and the clients are slaves; in other words, the access point assigns clients to the designated channel for dynamic load balancing.

For small networks with all the clients

Though larger than other access points, the RangeLAN2 access point provides good coverage.



link quality of the closest access point as well as any other access points within range. The Snoop utility is a basic spectrum analyzer that views radio activity in the 2.4-GHz band.

After the access points are in place, you're ready to roam. As with many of the products in this roundup, RangeLAN2's roaming was seamless. In addition, the system's coverage was among the best. We were able to cover our test area with only two access points without any perceptible dead zones. Our performance tests put RangeLAN2 slightly above the middle of the pack in throughput among all products; however, compared with other FHSS products, RangeLAN2 was first on nearly every test.—*PRB*

RangeLAN2. List price: RangeLAN2 7200 PCMCIA adapter, \$695; RangeLAN2 7500 Access Point, \$1,895. Proxim Inc., 295 N. Bernardo Ave., Mountain View, CA 94043; 800-229-1630, 415-960-1630; fax, 415-960-1984; sales@proxim.com. Circle 495 on reader service card.

SUITABILITY TO TASK

RangeLAN2

Installation and configuration **Good**

Management and administration **Excellent**

Mobile usability **Good**

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CIRCLE 044 ON READER SERVICE CARD

Direct-sequence products were the clear performance winners. But the frequency-hopping systems compensate for lower speeds with a scalable architecture and greater resistance to interference.

What the Numbers Mean

Radio-frequency wireless systems are intended to complement a wired LAN, not replace it. And like their 10-Mbps Ethernet brothers, these wireless LANs rarely if ever hit their rated theoretical maximum throughputs. The direct-sequence spread-spectrum (DSSS) products—rated at 2 Mbps—offered a little more than 1 Mbps on our single-client NetBench test. AT&T's WaveLAN offered the best performance at 1.35 Mbps, followed by Solecetek's Airlan at 1.24, Digital's RoamAbout at 1.2, and Aironet's Airlan at 1.04 Mbps. Among the frequency-hopping spread-spectrum

(FHSS) solutions, Proxim's RangeLAN2, at 0.54 Mbps, was more than twice as fast as BreezeCOM's BreezeNET (0.22 Mbps) and IBM Wireless LAN Entry (0.24 Mbps).

PERFORMANCE GAP

There are two reasons for the performance differences among the products tested. First, the vendors' wireless implementations vary when it comes to radio sensitivity, antenna diversity, software drivers, and processing power within the access point. The second and more important differentiator is the radio technology used in the product. All spread-spectrum radio systems distribute signals over a wide range of the spectrum. Each technology, however, has clear advantages: DSSS offers better performance, while FHSS provides better interference immunity and scalability.

DSSS products widen bandwidth by increasing the data bit rate. Each bit is broken into ten or more smaller bits, often called *chips*, which are sent simultaneously. By transmitting data this way, DHSS systems effectively increase data rate and expand bandwidth. But because the signal

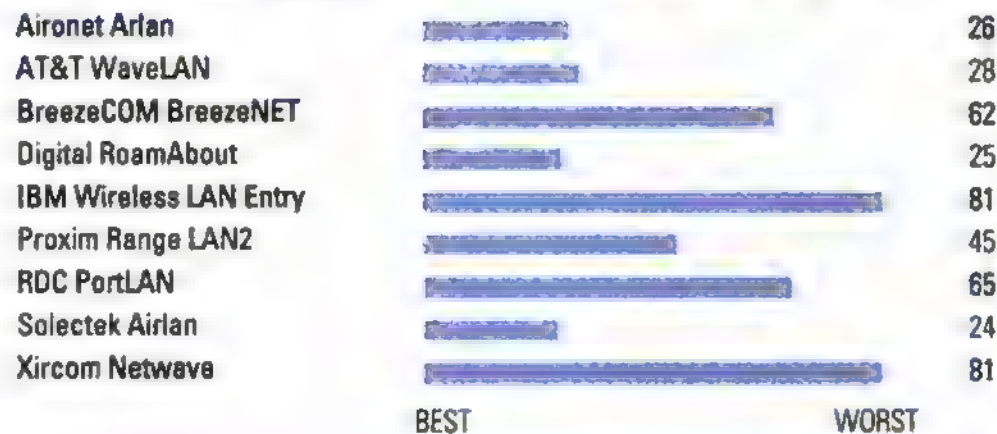
NOTES DATABASE REPLICATION

Minutes:seconds ▶ 0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00



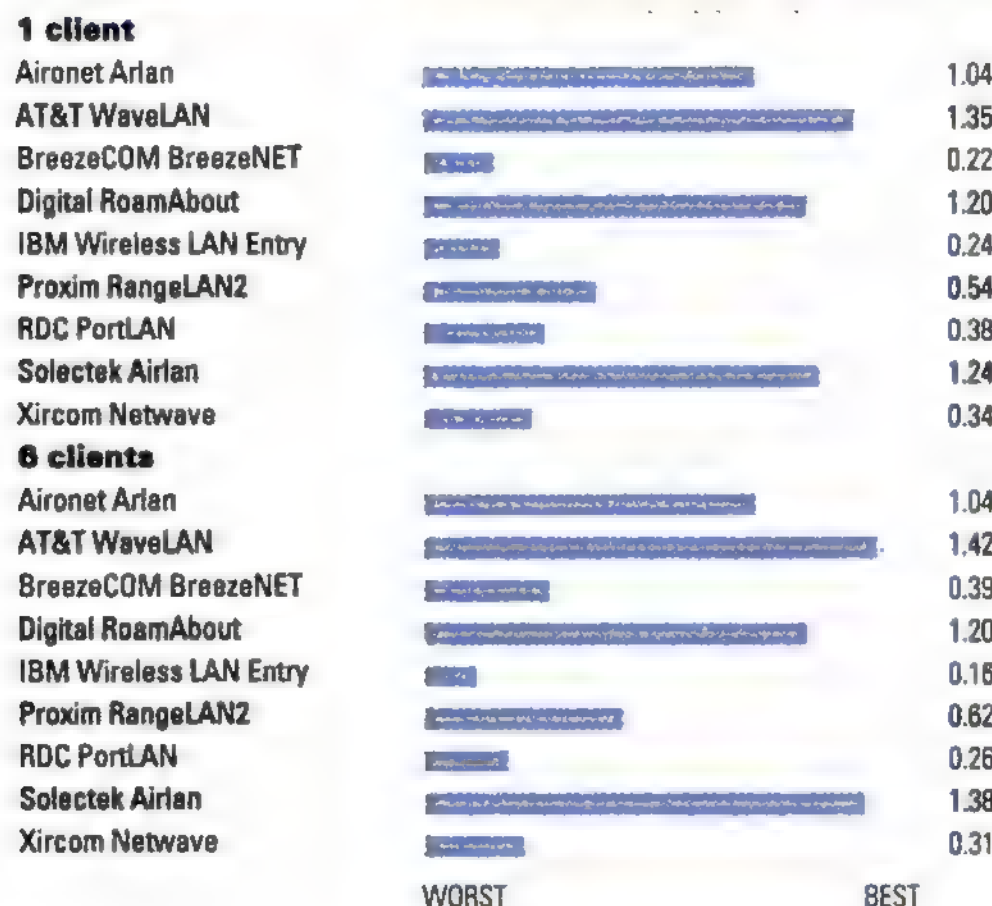
FILE TRANSFER

Seconds ▶ 0 10 20 30 40 50 60 70 80 90



NIC THROUGHPUT (ONE ACCESS POINT)

Megabits per second ▶ 0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6

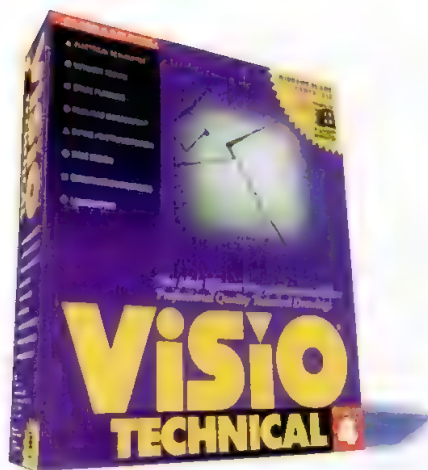


NIC THROUGHPUT (TWO ACCESS POINTS)

Megabits per second ▶ 0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8



N/A—Not applicable. The product does not support this configuration



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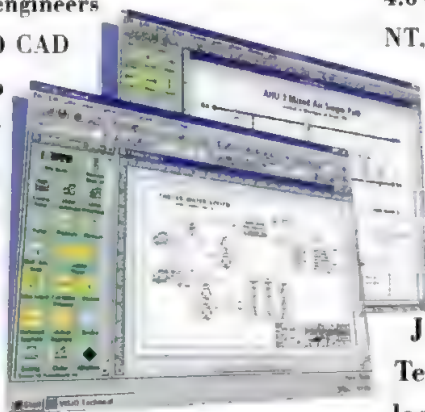
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spreads across the sequence, fewer nonoverlapping channels are available, which may create interference (referred to as *multipath*) on those frequencies. Systems that use DHSS also are less flexible because they usually cannot use multiple channels or take advantage of multiple access points to increase throughput.

An FHSS system sends a short burst of data to one frequency, then hops to another, then another, thereby better dodging interference. It also permits more than one channel or access point in the same area, which expands the bandwidth. Power consumption is always a concern when using mobile devices, and FHSS adapters typically require less than half the power of DSSS adapters.

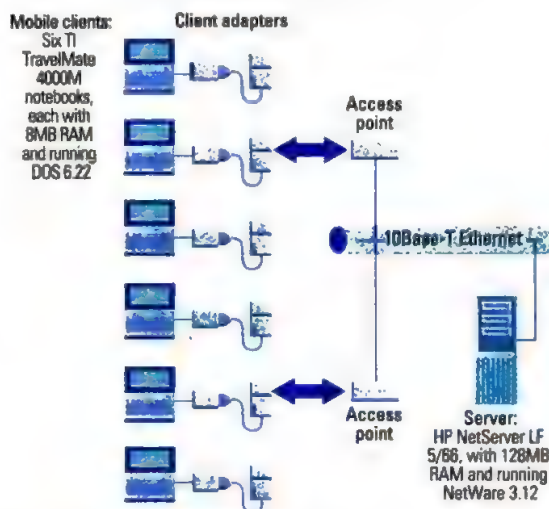
Using the NIC Throughput test from NetBench 4.0, we gauged performance of multiple clients by testing the simultaneous access of one through six clients with a single access point. For all the systems tested, we found little change in total throughput as we added clients. But the aggregate bandwidth must be shared among all clients using the access point. To set up your wireless applications properly, you'll need to consider actual client workloads.

We added a second access point to our configuration to test the scalability and load-balancing claims of the FHSS products. Of the DSSS products reviewed, only Aironet's Airlan allows multiple access points or channels in the same area. Although the Airlan offered the greatest throughput on the two-access-point test (1.69 Mbps with two clients, declining slightly to 1.55 Mbps with six clients), each of its access points had to be configured on a separate frequency. Airlan's load balancing of clients is not dynamic, which

means that clients cannot roam from one channel to another. The leader of the FHSS products again was the RangeLAN2, delivering 0.83 Mbps for both two and six clients, while IBM's Wireless LAN Entry was unable to scale, possibly because of a conflict of hopping frequencies used on the different access points. With the additional access point, RDC's PortLAN was able to double its throughput, and Xircom's Netwave and BreezeCOM's BreezeNET offered modest improvements.

To get a sense of performance in terms of real-world applications, we timed each system replicating Lotus Notes databases and transferring files. The results generally matched the pattern of the NIC Throughput test with Airlan, RoamAbout, and WaveLAN offering the best performance among the DSSS products and RangeLAN2 leading the FHSS solutions.—*Analysis written by Jeffrey G. Witt*

Wireless LAN Test-Bed



How We Tested

In our test-bed we installed Novell's NetWare 3.12 on an HP NetServer LF 5/66 with 128MB of RAM and 4GB of hard disk

space. The wireless clients consisted of six Texas Instruments TravelMate 4000M 486 DX4/75 notebooks running DOS 6.22. Each wireless adapter used NetWare VLM 1.2 drivers.

We measure the peak throughput of the wireless adapters with the **NIC Throughput** test of Ziff-Davis Benchmark Operation's NetBench 4.0 test suite. We start with one client, adding clients one at a time until we have six clients. We first test with one access point, then perform the same tests with two access points (with the products that could accommodate multiple access points in the same area). Our **Notes Database Replication** test represents the length of time one client requires to replicate seven Lotus Notes databases, which each contain 520 documents. The **File Transfer** test times one client transferring five different files with varying characteristics and compressibility.

RDC Networks Inc.

PortLAN



Wireless LAN systems are not exactly inexpensive. But with PortLAN we feel that you should get more for your money. The \$2,195 PortLAN AP access point and \$695 PC Card client adapter are fairly straightforward to install, but the system's unimpressive performance and paucity of features will make network administrators consider other wireless solutions. Also, at the time of our testing, the PortLAN was the only product reviewed that could not be used in a peer-to-peer configuration, though

the company plans to offer this capability by the time you read this.

Rather than a unit specially designed as an access point, the PortLAN AP is actually a 386/SX PC. The slimline computer, which operates using frequency-hopping spread-spectrum (FHSS) in the 2.4-MHz band, comes with an external antenna and its own Ethernet card. If you want to set up your own access point for less, consider RDC's PortLAN ISA Ethernet card package with radio and software for \$1,195.

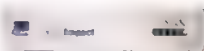
To set up PortLAN, you simply boot the access point with the preconfigured start-up disk that's included. If you want to

do much more than that, you'll be disappointed. You can change some basic settings, including a list of allowed users, the access points they can connect to, and their passwords, by editing the PortLAN's text configuration file, but that's about it.

Although this method can be tedious to manage and won't give you feedback on the access point's status, it makes it a snap to install and works with most popular NOSs, including NetWare 3.x and 4.x and Windows NT Server 3.51. Unfortunately, to do in-band configuration, you'll have to shell out an extra \$495 for the SNMP MIB software or \$1,995 for the MIB and management software that works with HP



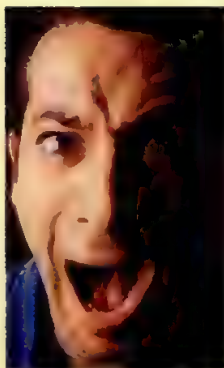
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SUMMARY OF FEATURES

Wireless LANs



	Aironet Wireless Communications Inc. Arian	AT&T Network Systems WaveLAN	BreezeCOM BreezeNET	Digital Equipment Corp. RoomAbout	IBM Corp. IBM Wireless LAN Entry	Proxim Inc. RangeLAN2	RDC Networks Inc. PortLAN
■ YES ■ NO							
In alphabetical order by company							
List price per LAN adapter	\$795	\$695	\$395	\$695	\$445	\$695	\$695
List price per access point	\$1,995	\$1,995	\$1,295	\$1,795	\$1,350	\$1,695	\$2,195
Hardware Features							
Modulation technique	Direct sequence	Direct sequence	Frequency hopping	Direct sequence	Frequency hopping	Frequency hopping	Frequency hopping
Frequency range used	2.4 GHz-2.4835 GHz	902 MHz-928 MHz	2.4 GHz-2.4835 GHz	902 MHz-928 MHz	2.4 GHz-2.4835 GHz	2.4 GHz-2.4835 GHz	2.4 GHz-2.4835 GHz
Suspend and resume	■	■	■	■	■	■	■
Power management	■	■	■	■	■	■	■
Hot swapping	■	■	■	■	■	■	■
Power requirements:							
Transmit	420 mA	600 mA	320 mA	550 mA	320 mA	300 mA	360mA
Receive	210 mA	300 mA	160 mA	295 mA	275 mA	150 mA	290mA
Sleep	10 mA	30 mA	N/A	35 mA	35 mA	5 mA	40mA
Plug and Play support	■	■	■	■	■	■	■
Card and Socket Services compatibility:							
Databook	■	■	■	■	■	■	■
Phoenix	■	■	■	■	■	■	■
SystemSoft	■	■	■	■	■	■	■
Ventura Micro/Award Software	■	■	■	■	■	■	■
Claimed closed space/open space range (feet)	300, 2,000	200, 800	220, 1,000	400, 800	300, 800	500, 1,000	450, 2,700
Claimed data throughput	2 Mbps	2 Mbps	1.2 Mbps	2 Mbps	400 Kbps	1.6 Mbps	1 Mbps
Access Point Features							
Dimensions (HWD, in inches)	20 x 80 x 60	20 x 80 x 16.0	10 x 3.5 x 5.0	10 x 110 x 50	30 x 110 x 8.5	35 x 100 x 15.0	30 x 10.0 x 13.5
Supports roaming	■	■	■	■	■	■	■
Cable types:							
10Base-T (UTP)	■	■	■	■	■	■	■
10Base2 (coaxial)	■	■	■	■	■	■	■
Automatic load balancing	■	■	■	■	■	■	■
Security:							
Access control	■	■	■	■	■	■	■
Encryption/Authentication	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
NOS Drivers							
LANtastic	■	■	■	■	■	■	■
Macintosh System 7.5x	■	■	■	■	■	■	■
Microsoft Windows for Workgroups 3.11	■	■	■	■	■	■	■
Microsoft Windows 95	■	■	■	■	■	■	■
Microsoft Windows NT Workstation 3.5x	■	■	■	■	■	■ (via BBS)	■
NetWare 3.x/4.x	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
NetWare Lite	■	■	■	■	■	■	■
OS/2 LAN client, Warp client	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■ (via BBS)	■ ■
NDIS version numbers	2.1, 3.1	2.1, 3.1	2.0, 3.0	2.1, 3.1	2.01	2.01, 3.1	2.1, 3.1
Management Features							
Filtering:							
Protocols	EtherTalk, IP, IPX	None	None	None	NetBEUI, NetBIOS	EtherTalk, IP, IPX	EtherTalk, IP, IPX NetBEUI, proprietary
MAC address/broadcast type	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Supports SNMP MIB II	■ (via BBS)	■	■	■	■	■	■
Management software included	■	■	■	■	■	■	■
Point-to-point diagnostics included	■	■	■	■	■	■	■
Site survey tool included	■	■	■	■	■	■	■
Service and Support							
Warranty (parts and labor)	1 year	1 year	1 year	1 year	3 years	1 year	1 year
Technical-support number	216-665-7903	800-288-9283	619-431-9880	800-457-8211	800-426-7299	415-960-1630	415-577-8075
Hours (eastern time)	8:00-5:00 M-F	9:00-5:00 M-F	10:00-8:00 M-F	24 hours, 7 days	8:30-4:30 M-F	6:00-6:00 M-F	10:00-9:00 M-F
BBS number	216-873-2040	612-638-8494	None	508-486-5777	919-517-0001	415-960-2419	None

N/A—Not applicable: The product does not have this feature

(Aironet and Proxim also offer ISA adapters.) Like the PC Card version, these two adapters include drivers for Artisoft's LANtastic, NetWare, Windows for Workgroups, and other NDIS- or ODI-compliant network operating systems.

FAST TRACK

Airlan showed some of the best performance on our tests, second only to AT&T's WaveLAN. Its results were similar

SUITABILITY TO TASK

Airlan

Installation and configuration	Fair
Management and administration	Fair
Mobile usability	Good

to Digital's RoamAbout, with Airlan placing slightly ahead. Like other DSSS products, though, Airlan does not support automatic load balancing among access points,



Solectek's Airlan/Access, licensed from Digital, delivered good throughput.

and allows just one access point in a single area of coverage. (Aironet's Airlan, a DSSS product, allows three access points in overlapping coverage, but it cannot load-balance clients among them.)

The included peer-to-peer diagnostic utility measures the signal-to-noise ratio (SNR), and the signal quality between two clients. These are useful for diagnosing problems and might help indicate where to place access points, but the utility only works in peer-to-peer mode and cannot view access points. Digital's utilities view every access point in range and deliver the same statistics as Airlan's utility. —PRB

Airlan. List price: Airlan/PCMCIA, \$699; Airlan/Access, \$2,499. Solectek Corp., 6370 Nancy Ridge Dr., # 109, San Diego, CA 92121-3212; 800-437-1518, 619-450-1220; fax, 619-457-2681; <http://www.solectek.com>. Circle 497 on reader service card.

Xircom Inc.

Netwave



The compact, inexpensive Netwave system, which uses frequency-hopping spread-spectrum (FHSS) transmission in the 2.4-GHz band, has relatively low performance and a short roaming range. Nevertheless, it's an affordable wireless LAN system with attractive features such as central management, NetWare spoofing, an unobtrusive antenna, and the best client software in this roundup.

The Netwave CreditCard adapter (\$399) has no bulky antenna or cumbersome cables—it's just a single PC Card with a small, rectangular antenna jutting out. The CreditCard serves double duty: The Netwave Access Point (\$1,499 has a PC Card slot that uses the same adapter as the clients. Although nicely designed, the adapter's stubby antenna contributes to Netwave's shorter range of coverage.

Xircom's client adapter installation is head and shoulders above the other wireless products we reviewed. A simple Windows program automatically modifies ODI and NDIS configuration files, installs Netwave's TSR, and modifies DOS start-up files.

Managing Netwave access points is convenient with Xircom's DOS-based APMGR program. The program, which you can run from any networked PC, lets you change basic access-point parameters (such as its name and domain number) and set security features. Xircom offers encryption so that data is secure even if an unauthorized user is able to connect to the access point. Another security feature lets you restrict allowable connections to a list of individual users, which is less secure but easier to set up and manage than encryption.

For NetWare sites, Xircom includes an optional NetWare Loadable Module (NLM) that monitors user connections. The information provided from the file server console, however, is minimal; it basically informs the administrator whether or not a wireless user is still connected to the LAN.

NETWORK TRICKSTER

Roaming worked very well. Switching between access points yielded no noticeable interruption in network activity. The product's unique NetWare spoofing lets users

roam beyond a Xircom access-point cell and still appear to be logged on to the NetWare server. The Netwave client software and access point work in concert to trick Windows and the server into keeping the network connection intact for up to 18 hours. If you try to access network resources outside your coverage, Xircom's client software notifies you that the network is unavailable. Come back into range and you're connected.

As with most products reviewed here, choosing the optimal location of an access point was somewhat hit-or-miss, although Xircom's Site Survey application helped a little. Netwave also automatically load-balances among two or more access points in the same area of coverage, increasing overall throughput. Xircom claims that as many as 78 access points could operate in the same area of coverage; however, it recommends no more than 20 access points for optimal aggregate throughput.

Netwave's compact size, unhindered by external radio or antenna appendages, is a nice feature. Better throughput and greater range would improve the product. But for tight-quartered implementations, Xircom is worth serious consideration. —TP □

SUITABILITY TO TASK

Netwave

Installation and configuration	Excellent
Management and administration	Good
Mobile usability	Good



Compact and inexpensive, Xircom's Netwave uses transceivers with built-in antennas.

Netwave. List price: Netwave CreditCard adapter, \$399; Netwave Access Point, \$1,499. Xircom Inc., 2300 Corporate Center Dr., Thousand Oaks, CA 91320; 800-438-4526, 805-376-9300; fax, 805-376-9311; <http://www.xircom.com>. Circle 498 on reader service card.

PC Tech

THE DEFINITIVE GUIDE TO PC TECHNOLOGIES & TOOLS

Windows 3.1 Memory Enhancement Utilities

The right utility can help you past major memory roadblocks in Windows 3.1.

By Matt Pietrek and Larry Seltzer

Is it too late in the day to review memory enhancement utilities for Windows 3.1? Actually, there's never been a better time to do it. If you belong to that large majority of Microsoft Windows users who have not yet upgraded to Windows 95 or Windows NT, you're probably more aware than ever of the painful memory and resource limitations imposed by Windows 3.1x. A class of software products has emerged that attempts to address these problems. Some can perform remarkable feats of memory optimization; others can't.

We tested five utilities that claim to overcome a variety of limitations in Windows 3.x: Helix Software's Hurricane 1.02; Quarterdeck's



THANKS FOR THE MEMORY Five leading memory enhancement utilities for Windows offer everything from spectacular results to almost no results at all.

IN THIS SECTION



TUTOR Three innovative uses for Windows 95's Find utility: deleting all files of a certain type in one fell swoop, finding data buried within a compressed .ZIP archive file, and determining whether any of your executable programs require a dynamic link library that you'd rather delete. *page 215*



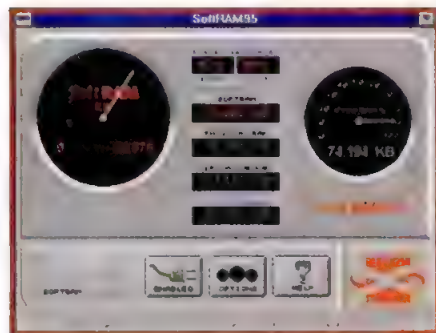
POWER PROGRAMMING

Windows 95 has a new standard status bar control that allows consistency among applications. Jeff Prosise has written two C++ programs to demonstrate how you can take advantage of the new control. The first displays help for menu items, and the second adds information on the NumLock, Scroll-Lock and CapsLock keys and implements an indented 3-D style. *page 218*



UTILITIES Warp Cabinet gives OS/2 Warp a combination of Windows 3.1's File Manager and the Windows 95 Explorer. This powerful file management utility makes it easier to move, copy, and rename files from a two-pane window showing drives and folders on the left and filenames and icons on the right. *page 223*

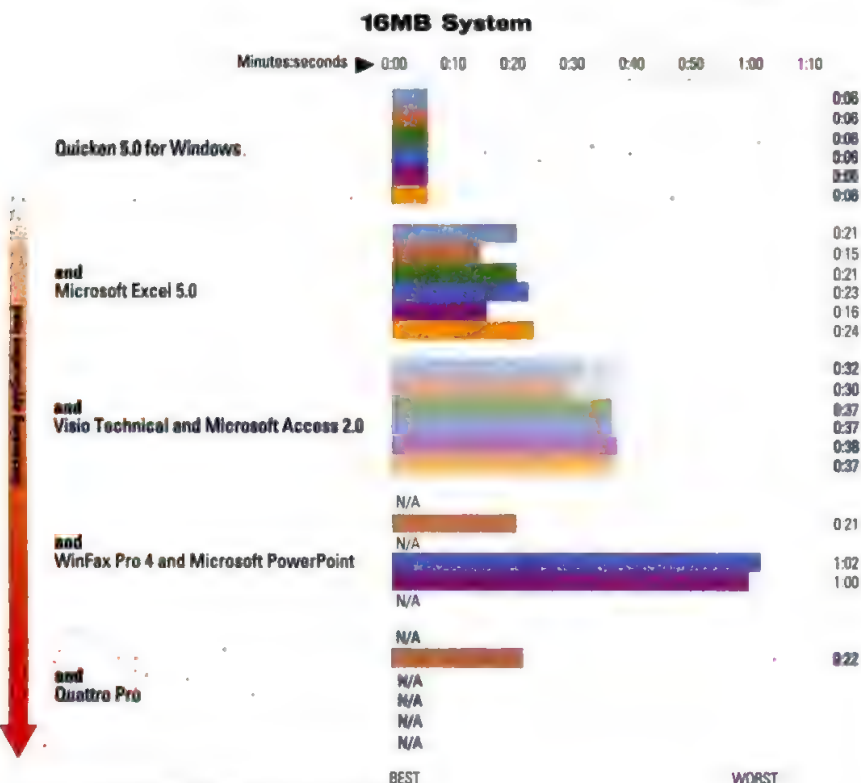
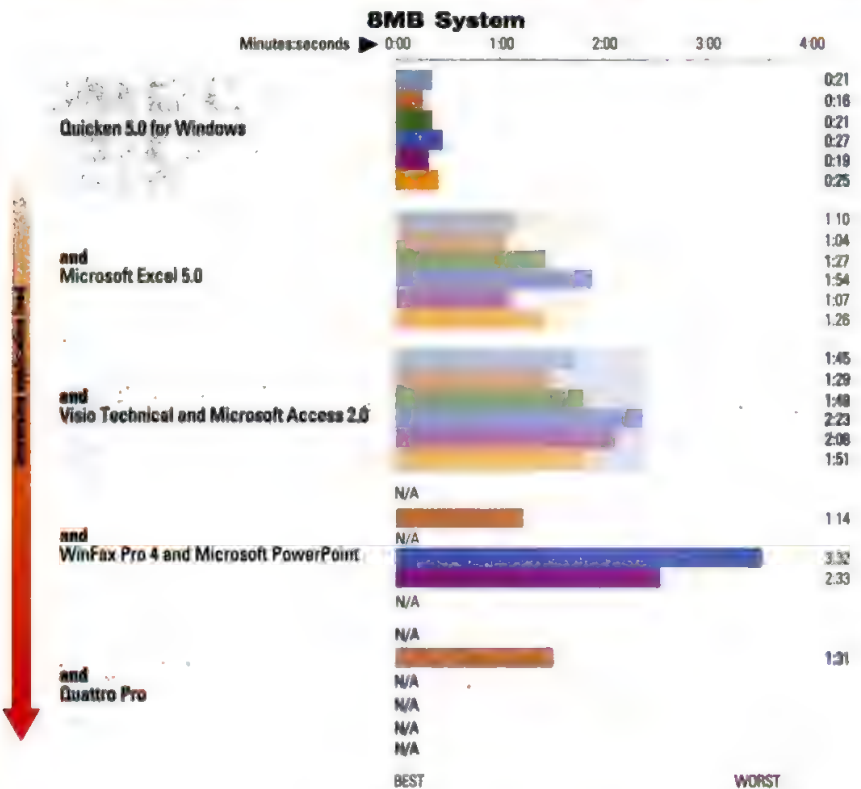
ALSO IN THIS ISSUE User-to-User shows you how to delete all files created before or after a specified date in Windows 95. In the Ask Our Advisors section, find out what prevents you from printing more than 99 copies at a time; how to connect two Windows 95 machines to one CD-ROM drive; how to install OS/2 Warp FixPack 10; how to send data directly to your printer in Paradox for Windows; and more. *page 227*



Not every gauge is what it seems. page 211

PERFORMANCE UNDER INCREASING APPLICATION LOAD

Windows 3.1 (plain) Hurricane MagnaRam 2 QEMM 8 RAM Doubler SoftRAM 95



N/A—Not applicable: Additional applications could not be loaded

QEMM 8 and its subset, MagnaRAM 2; RAM Doubler 1.02, from Connectix; and Synchronys Software's SoftRAM95 2.0.

Their success rates varied tremendously. Our tests revealed that the strongest can bring major improvements to Windows 3.x's memory and resource management. But the weaker products give you few appreciable benefits—or none whatsoever.

RAM COMPRESSION

Many of these products attempt to solve the problem of running out of global memory under Windows 3.1. Four of them—MagnaRAM 2, QEMM 8 (which incorporates MagnaRAM 2), Ram Doubler, and SoftRAM95—approach this problem using a technique called *RAM compression*. The idea is that by using a compression algorithm to fit the contents of RAM into fewer physical bytes of memory, RAM compression lessens the system's need to read or write to virtual (hard disk-based) memory. Virtual memory is orders of magnitude slower than physical RAM.

We're skeptical: If the theory were valid, RAM compression would show a measurable performance benefit. All indications from our testing are that RAM compression either makes no appreciable difference or slows the system down.

The big problem is that it takes RAM to make RAM. Compression products generally work by intercepting Windows' paging process. When the system begins to run out of physical memory, Windows begins to swap pages (4K regions) of memory to its disk-based swap file to clear more physical memory. The RAM compression products instead allocate a large area of RAM (typically defaulting to 25 percent of physical memory). Then instead of paging to disk, they compress the page into that large buffer. When specific pages are needed from the swap file, the product decompresses them back to real RAM. When the buffer itself is overcommitted, the product pages from it to disk.

Unfortunately, the dedicated buffer consumes a large amount of memory that would otherwise be directly available to applications for real use, and the compression and decompression processes themselves consume significant processor time. The bottom line is that you need a large overall compression ratio to overcome these obstacles. The fact that most of the memory paged in Windows 3.1x is code, which is not conducive to compression, compounds the obstacles further.

SoftRAM95 represents a special case among the RAM compression products. Our tests clearly indicate that, despite Synchronys Software's claims to the contrary, it does not successfully perform any RAM compression whatsoever.

SYSTEM RESOURCES

Almost all Windows 3.x users have experienced crashes or been unable to load additional applications because available Windows system resources dipped below usable levels. This condition is particularly annoying, since it can easily occur in systems with generous amounts of RAM, much of which may still be free. All the products we tested except MagnaRAM 2 claim to take measures to increase the effective supply of system resources. Here, too, our tests revealed mixed results.

What exactly are system resources? Windows 3.1x loads your applications into a large 32-bit address space (up to 4GB) that sits above conventional memory. But it also maintains a number of smaller 16-bit memory areas only 64K in size that it uses to store certain critical data structures needed by applications and Windows itself. The space left in these *local heaps* at any given moment determines the amount of free system resources. Windows maintains six such heaps. The percentage of free resources Windows reports is the amount of space left in whichever of the heaps is lowest.

Among the products that claim to boost resources, we found that Hurricane's methods are both the most interesting and the most effective. Under Hurricane, we simply could

Helix Software's Hurricane

The most difficult part of awarding an Editors' Choice for Windows optimization is that the cate-

gory is not clearly definable. All the products we reviewed attempt to mitigate limitations in Windows, but they tackle different limitations and use widely varying techniques to do the job.

That said, Helix Software's Hurricane clearly solved more problems in more successful ways than any competitor. Helix improved Windows' performance rather than slowing things down, and it delivered the best expansion of system resources of any product we tested. Nothing else came

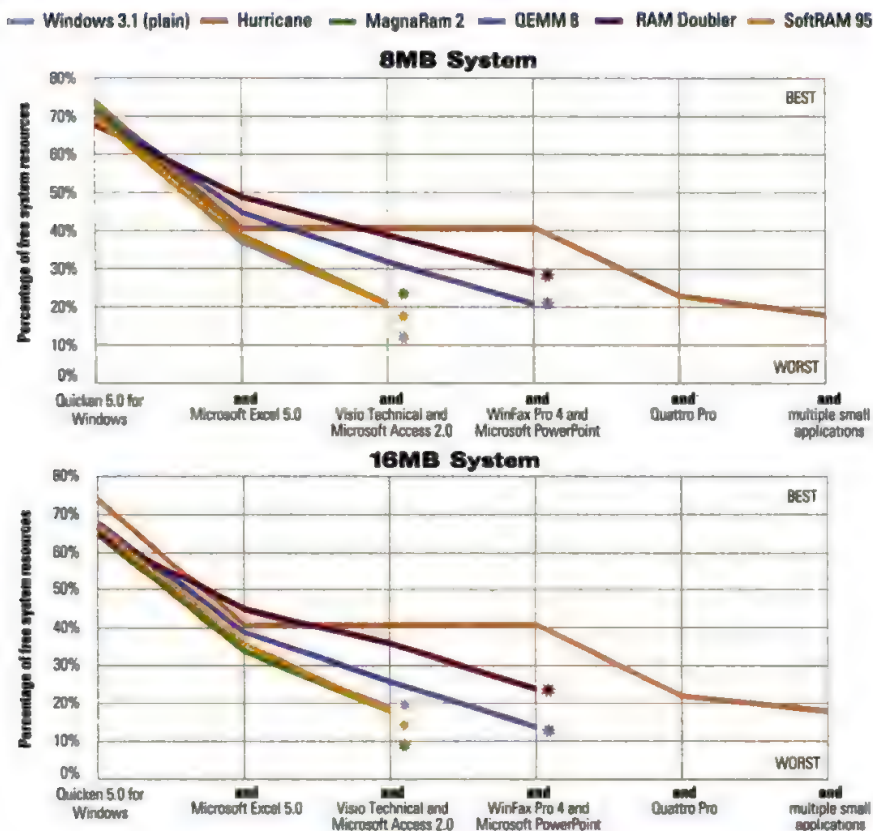
close to letting us load and run so many applications at once. For best results, you'll need to use Hurricane's control and diagnostic utilities, but the benefits are well worth the trouble.

Connectix Corp.'s RAM Doubler deserves an honorable mention for doing a good job expanding system resources and doing so elegantly. RAM Doubler installs and uninstalls incredibly easily and loads only a single VxD from the SYSTEM.INI file. All the other products here clutter the configuration files with many more lines.



not make the test system run out of resources. At the other end of the spectrum, SoftRAM95 once again floored us. In spite of explicit indications from its gauge software indicating that it expands resources, we could find no evidence that SoftRAM95 does anything to affect system resources in any way.

SYSTEM RESOURCES UNDER INCREASING APPLICATION LOAD



* Additional applications could not be loaded.

CONVENTIONAL-MEMORY MANAGEMENT

The last major benefit that all the products but MagnaRAM 2 claim to offer is enhancing the availability of conventional memory under Windows. Windows applications and Windows 3.x itself use this finite and scarce resource (the first 640K of memory) for many purposes, frequently unnecessarily.

Most of the techniques the products use involve allocating all of conventional memory temporarily, at which point Windows falls back to using memory above 1MB. Hurricane and QEMM are also smart enough to use free upper-memory blocks (between 640K and 1MB) as conventional memory under Windows. Normally Windows will not allocate these blocks to applications, even if you have gone to the trouble of using memory management software to free them up.

OUR TESTING STRATEGY

We used two tests to evaluate Windows enhancement products. The first consists of a long, manually executed application script that involves loading and using up to 21 concurrent applications, first under plain Windows and then under each tested product. In this test, we measure both the time required to complete individual script tasks and the percentage of free system resources at each load level. The second test is a diagnostic for confirming that the products are performing RAM compression. Results for both tests are reported in the accompanying charts ("Performance Under Increasing Application Load," "System Resources Under Increasing Application Load," and "RAM Compression Reality Check").

THE APPLICATION SCRIPT TEST

This consists of a long sequence of loading applications and performing tasks with them, then switching back to Program Manager

DOUBLE YOUR MEMORY.

*Not your really expensive
useless hardware collection.*

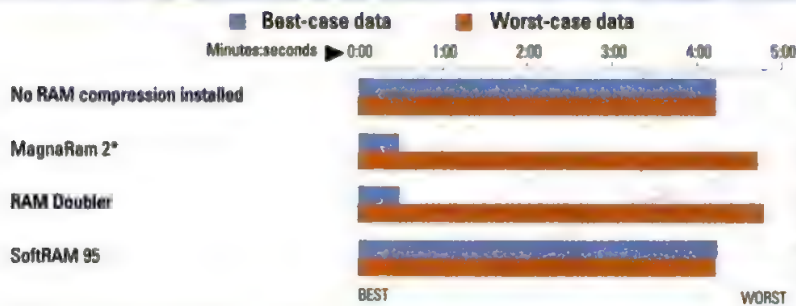


Your computer won't do much at once. So you install more RAM. And what happens? You end up with a really expensive computer that won't do much at once. That's because physical memory does nothing to eliminate Windows® memory bottlenecks. Connectix RAM Doubler™ software fixes that by increasing system resource space, reclaiming unused memory and compressing existing memory. It installs in 15 seconds and works automatically every time you start Windows. So now with RAM Doubler you get to run more applications at once and turn that costly paperweight sitting on your desk into the powerful computer it was meant to be.



Memory Enhancement Utilities

RAM COMPRESSION REALITY CHECK



* QEMM 8 uses MagnaRam2 as its RAM compression component.

Our RAM compression test measures the time each product takes to manipulate two different 32MB data sets in a 16MB system. The best-case data is highly compressible. The worst-case data is poorly compressible. In both scenarios, a significant difference between a product's score and the uncompressed score indicates that RAM compression is taking place.

and loading an additional application. We timed how long it took to load the applications and how long it took to perform each task, and we noted the level of free system resources when we were done with each application. At two points within the script, we switched from one application to another and performed tasks in the second app. We continued the script until we were unable to load additional applications or until the system crashed.

The applications, in the order loaded, were Intuit's Quicken 5 for Windows, Novell's WordPerfect 6.0 for DOS, Microsoft Excel 5.0, Visio Corp.'s Visio Technical, Microsoft Access 2.0, Delrina WinFax Pro 4.0, Microsoft PowerPoint 4.0, id Software's DOOM, Microsoft Word for Windows 6.0a, Microsoft Visual Basic 3.0, and Novell's Quattro Pro for Windows.

If the system was able to load all these applications, we went into a loop of loading copies of Windows Notepad, one of its games, and Windows Paint. We used different text files and bitmaps with each copy of Notepad and Paint, and the games we loaded were Minesweeper, Solitaire, and Hearts. We did not time these loads, but we did measure free system resources after each load. A system that made it all the way through this test would have 21 applications loaded. We tried to select applications that we knew to be fairly resource-intensive. Timed tasks included loading complex files, printing them, switching between documents, creating charts, and bringing up complex dialog boxes. If a system was unable to complete a task, we tried to continue the script anyway while noting the failure. We stopped only when the system either crashed or was unable to complete any additional tasks.

THE RAM COMPRESSION DIAGNOSTIC

This test allocates a list of 65,000-byte strings and then fills them with either random data or the same ASCII character. The repetitive data provides a best-case scenario for a compression algorithm, while random data is the worst case. We allocated enough strings to occupy about twice the size of physical RAM.

The test measures how long it takes to swap adjacent bytes in the entire list of blocks. Because we allocated twice the amount of memory as there is RAM in the system, we forced

The random-data cases should page to disk about as much as the plain Windows system, but they have an added processing burden for the compression and decompression.

We tested the products on two different system configurations: a Compaq 486/66 with 8MB of RAM and a Micron P133 with 16MB of RAM. The Compaq had an IDE drive; the Micron had a SCSI hard disk. Both systems ran Windows for Workgroups 3.11 and DOS 6.22. The 486/66 system ran Stac Corp.'s Stacker, Version 4.2.

Helix Software

Hurricane 1.02

ALL REVIEWS BY LARRY SELTZER

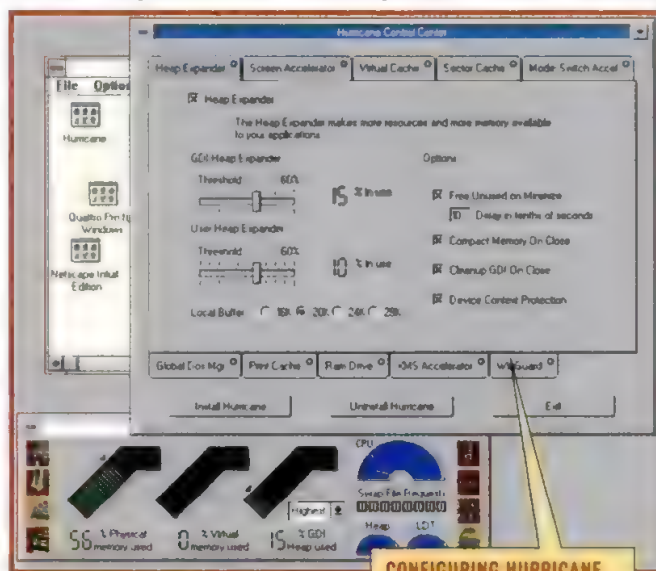


In a software category where marketing claims run to hyperbole, Helix Software's promise that Hurricane 1.02 will speed up your computer is downright modest. Hurricane, our Editors' Choice winner, certainly does speed up Windows, but it does much else besides. In testing, it provided effectively unlimited Windows resources and noticeably better performance than plain Windows or any competing product. Hurricane also gives you an intelligent set of installation and tuning tools. Its only downside is that setup can be challenging, and getting optimal results often requires manual tweaking and mastering of some technical concepts.

The results are well worth the effort, however. With Hurricane installed, you'll almost certainly run out of something else long before you run out of resources. Hurricane's Heap Expander attacks resource limits in two ways. First, it moves certain large resources out of the 16-bit local heaps to Hurricane's own 32-bit areas, where memory is cheap, replacing them with dummy monikers. When an application needs the resource, Hurricane swaps it back in place. Hurricane's second approach is to give each application its own set of 64K heaps. Where other products may pick at most three key heaps to expand, Hurricane does five out of a possible six.

Heap Expander also performs some management of global Windows memory to make it more efficient. For example, it cleans up memory and resources that don't normally get freed by Windows when the application closes. Hurricane does not attempt to compress global Windows memory.

Under Hurricane, our test system ran the scripted application tasks faster than under plain Windows, typically showing a 10- to 30-



HURRICANE'S CONTROL CENTER

CONFIGURING HURRICANE means doing your homework, but the results are well worth the effort.

paging to occur. As expected, the numbers on a plain Windows system for the random and the repetitive data were equal. We then looked at each product's scores with the different data types. A system that performs RAM compression should be faster on the repetitive data, because it probably does not need to page to disk at all to complete the test.

Memory Enhancement Utilities

percent improvement depending on the application load. It also ran faster than under any of the other products reviewed. One of the reasons is Hurricane's optimized replacement for the code Windows uses for mode switching. Under Windows, switches between Real, protected, and Virtual 86 modes are frequent and costly. Hurricane's Mode Switch Accelerator speeds up some mode switches and eliminates others. Hurricane also turns on certain Pentium features that Windows normally doesn't use.

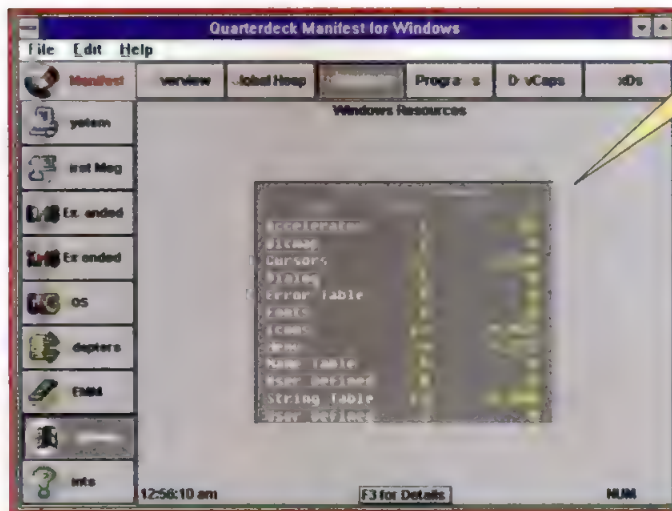
Most of Hurricane's other acceleration features are built around its Virtual Cache, a central cache pool for other caches in the system. If you are running 32-Bit File Access in Windows for Workgroups 3.11, Virtual Cache will directly supply it memory in a way that outperforms Windows for Workgroups on its own. In fact, if you are running Hurricane, you usually won't run SmartDrive, unless you need it for DOS programs you run outside of Windows.

You can set VCACHE to grow as large as it wants or you can give it a maximum. We found that the minimum size setting had a large effect on system performance, especially on low-memory systems. On our 4MB system, Hurricane defaulted to a minimum 1MB VCACHE. Lowering this to 256K significantly improved system performance.

Sector Cache is the disk cache Hurricane uses for drives that are not running 32-Bit File Access. Sector Cache will cache floppy disks, CD-ROMs, and even network drives. Hurricane also contains a RAM drive and print cache that grows and shrinks using memory from VCACHE. Hurricane's print cache can provide the equivalent of a background printing thread for all applications.

Hurricane's Global DOS Manager (GDM) manages memory below 1MB. While Windows is loading, GDM allocates all of conventional memory to itself. As other components such as DLLs and Windows device drivers load during the boot process, they will attempt to load in extended memory. If they fail to load, GDM frees up enough conventional memory for them and retries. In this way, conventional memory is reserved for only those components that really need it. GDM also makes upper memory blocks (UMBs, the areas between 640K and 1MB) available as global DOS memory under Windows; normally, Windows will ignore UMBs.

Installing Hurricane is easy if you choose Express Setup, though we found that the defaults may not be optimal. Tweaking is done through the well-organized Control Center,



QEMM 8'S MANIFEST ANALYSIS TOOL

but the parameters are technically complex. The lack of online help means you must read the manual, but fortunately it contains one of the best explanations of Windows memory and resources we've read anywhere.

While running the system under Hurricane, you can use the WinGauge program to monitor use of memory, resources, and the CPU. The Discover for Windows system-analysis tool aids fine-tuning by providing a wealth of useful information and some system benchmark tests.

Hurricane is a complex product that will work best in the hands of a proactive user. But for squeezing every ounce of capacity and performance out of 16-bit Windows, it's hands-down the best package around.

Hurricane 1.02. List price: \$79.95. Helix Software, Long Island City, NY; 800-451-0551; <http://www.helixsoftware.com>. Circle 486 on reader service card.

Quarterdeck Corp.

QEMM 8 MagnaRAM 2

QEMM 8 is the latest incarnation of the famous DOS memory manager, now enhanced with several features specifically for Windows. One of these features is a full, bundled version of MagnaRAM 2, Quarterdeck's standalone Windows RAM compression product. QEMM 8 also includes Windows resource expansion and Windows conventional-memory management.

Our tests clearly demonstrated that MagnaRAM 2 performs RAM compression, but its value to the end user is questionable. We were unable to load additional applications above and beyond what plain Windows allowed, and the product measurably slowed down the system under heavy load conditions.

QEMM 8's additional resource and memory management features did let us load more

AN OLD STANDBY. QEMM 8's Manifest system analysis tool is a part of the package.

apps than unvarnished Windows, and it increased the Windows resources available under a given load. But it also slowed Windows performance by a noticeable margin.

MagnaRAM 2 compresses Windows memory into a large buffer, which defaults to 25 percent of physical RAM. We suspect that this huge loss of memory, which normally would be available for applications, is responsible for the performance loss we saw. You can change the size of this buffer as well as the percentage full at which MagnaRAM 2 (or QEMM 8) compression kicks in. We

found it interesting that the manual advises users who experience performance loss either to make the buffer smaller or to raise the compression threshold. In other words, it tells users to have MagnaRAM 2 perform less compression.

There are two conceivable reasons you would want to get more memory: to enhance performance or to increase the number of applications you can load. In our application task tests, MagnaRAM 2 did not accomplish either goal. Whether or not MagnaRAM 2 gave us more global Windows memory didn't matter in the end; we ended up running out of either resources or conventional memory.

Theoretically, a case in which compression like MagnaRAM 2's should yield high compression ratios is possible, enhancing overall performance by reducing swap file paging. This is not likely to be a common situation, especially under Windows 3.x, where most of memory is occupied by code, which isn't conducive to compression. However, MagnaRAM 2 will not consume more of your disk space by increasing the size of your swap file, as SoftRAM95 does. It defers page writes to disk until idle time, so it acts as a sort of disk cache for the swap file. This could improve performance in some situations.

FreeMeg, QEMM 8's Windows conventional-memory manager, is reasonably well designed, but QEMM 8 contains a significant bug that prevents FreeMeg from functioning much of the time. Both FreeMeg and QEMM 8's Resource Manager module need to hook LoadModule, a Windows call, but FreeMeg's hook is undone when the Resource Manager hooks LoadModule. From this point on, FreeMeg can't function.

QEMM 8's Resource Manager does improve the Windows resource situation, but nowhere near as much as Hurricane or RAM Doubler. In general, test systems running under MagnaRAM 2 or QEMM 8 were slower than under

RESULTS FROM MAGNARAM are indicated in detail, but do they add up to a real benefit?

plain Windows. On an 8MB system, QEMM 8 was moderately slower than MagnaRAM 2; on a 16MB system, both performed about the same.

QEMM 8 comes with its familiar set of tools, including the system analysis tool Manifest and the memory optimizer program. The MagnaRAM optimizer reboots the system at least three times for each optimization, which is not quite as bad as it seems since QEMM 8's QuickBoot is enabled by default. QuickBoot, which disables most of the hardware power-on self test (POST) during the boot process, is also hooked into the Ctrl-Alt-Del key combination, so your own reboots go faster. Skipping the POST makes you a little nervous, but we've never seen a problem with it.

It's hard to recommend MagnaRAM 2 unless you're dealing with huge amounts of highly compressible data in RAM. QEMM 8 offers more solid gains, but not as many as some competitors.

MagnaRAM 2. Estimated street price: \$40. **QEMM 8:** Street price: \$70. Quarterdeck Corp., Marina del Rey, CA. 800-683-6696; <http://www.quarterdeck.com>. Circle 487 on reader service card.

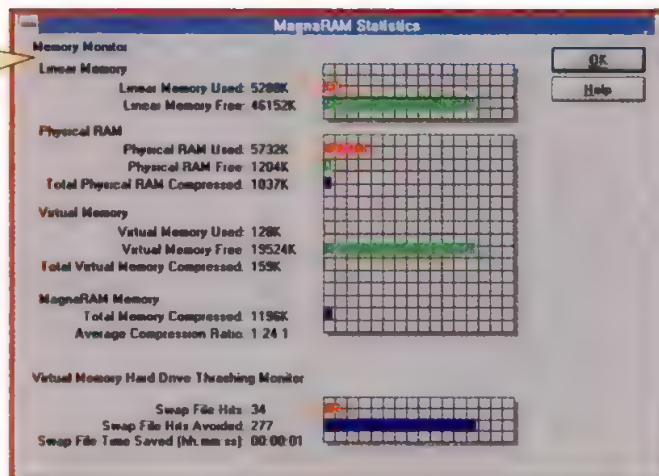
Connectix

RAM Doubler 1.02

Connectix's RAM Doubler is an elegantly simple program. It's not quite as powerful as Hurricane, but it has a lot going for it. Where Hurricane gives you extreme flexibility in configuration and requires that you master technical concepts to use it, RAM Doubler is as simple as possible. It has no configuration options whatsoever, just installed and uninstalled states.

Installing RAM Doubler is no harder than running its setup program and clicking on the Install button. To uninstall it, you run the same setup program and choose the Uninstall button. The only change RAM Doubler makes in the system configuration is to load a single VxD (ramdubl.386) in the 386 Enhanced section of SYSTEM.INI. RAM Doubler makes no changes to CONFIG.SYS, AUTOEXEC.BAT, or WIN.INI and has no additional .INI files of its own.

While it's running, RAM Doubler merely displays "RAM Doubled" in the desktop's



lower-right corner. It also modifies the About Program Manager dialog box to display free system resources as well as the amount that would be free without RAM Doubler. When you first start Windows, these numbers can indicate a small net loss of resources due to RAM Doubler itself, but it doesn't take long before you consume enough resources to result in a net savings.

In some cases these savings are considerable, and the "Without RAM Doubler" line can display a negative value. At the last point in our application-task test where both the RAM Doubler and plain Windows systems had all the same software loaded, RAM Doubler left 36 percent of Windows resources free compared with 18 percent for plain Windows. At that point, the Windows system was unable to load the next application (Microsoft PowerPoint, a voracious resource consumer). Under Ram Doubler, we were able to load most but not all of the remaining test applications.

RAM Doubler extracts some performance penalty for its resource magic. This is partly because it extends resources by physically moving them in and out of the actual resource heap as necessary and also because it is very conserva-

tive in doing so. In our application script test results, the performance hit was noticeable under heavy application loads. With fewer apps loaded, the RAM Doubler system was actually a bit faster than the baseline system.

RAM Doubler does attempt to increase conventional memory as well as compress RAM. To manage conventional memory, RAM Doubler marks all of it as allocated and then frees some up only for allocation requests that it approves of. Its memory compression is different from MagnaRAM 2's in that RAM Doubler does not set aside a large buffer for compression on a demand-paging basis, but instead compresses it at idle time.

The other interesting thing about RAM Doubler's RAM compression is that it attempts to identify the current working set in the system and only compress memory that is not in it. Therefore, RAM Doubler often pays an additional penalty when switching tasks, as it needs at that time to decompress a lot of RAM. The other implication of this is that on lower memory systems, especially on 4MB but sometimes on 8MB, all of physical memory may be in the working set, so little or no RAM compression occurs.

Still, RAM Doubler clearly lets you go beyond what plain Windows has to offer, and its extremely simple installation will be particularly appealing to users who want results without having to pore over technical manuals. **RAM Doubler 1.02.** List price: \$99. Connectix, San Mateo, CA. 800-950-5880; <http://www.connectix.com>. Circle 488 on reader service card.

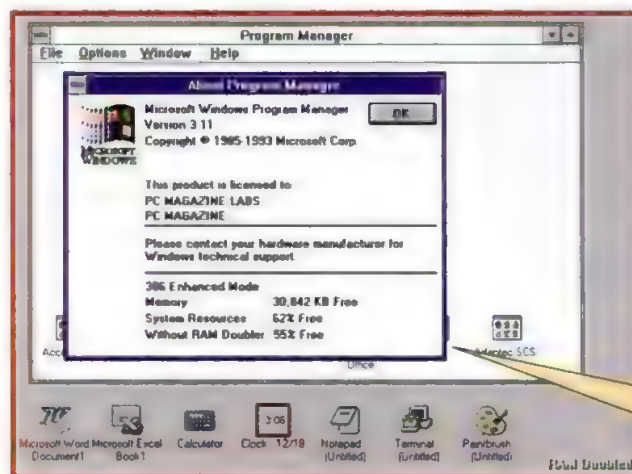
Synchronys Software

SoftRAM95 2.00

We've rarely seen such a big gap between what a product claims to do and what it actually delivers. After careful testing, we found no evidence that SoftRAM95 performs any of the main functions it claims to perform, including increasing global memory through RAM compression,

boosting the amount of available Windows resources, and accurately reporting the system's available memory and resources.

Our resource and RAM compression tests produced identical results running under SoftRAM95 and plain Windows. In our application-task tests, SoftRAM95 did



RAM DOUBLER

A SPARTAN ADDITION to the Program Manager About box is RAM Doubler's fanciest interface feature.



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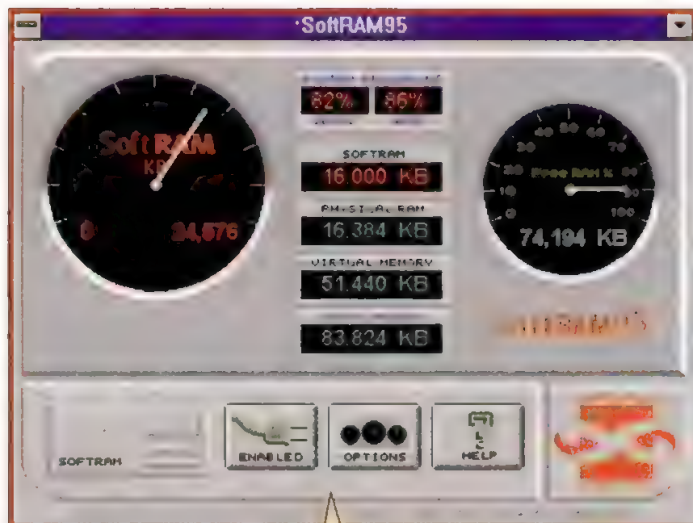


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SOFTRAM 95

not let us load more apps than Windows did—although it did slow Windows down. SoftRAM95

does manage conventional memory, but flaws prevent any overall benefit to the user. And despite the product's "95" moniker, Synchronys has stated that bugs prevent SoftRAM95 from working reliably in Windows 95.

Our RAM compression test forces the system to manipulate a huge block of data that is twice the size of physical memory. The block is either highly compressible repetitive data or poorly compressible random data. SoftRAM95's scores with both blocks were virtually identical and matched the scores for the plain Windows control system. These results indicate that RAM compression is not taking place (scores for other products claiming RAM compression showed large differences between the two data blocks). Synchronys told us that SoftRAM95 does compression only at idle time and that we needed to modify our diagnostic test to allow for this. We modified it accordingly, but our results were unchanged.

SoftRAM95 includes a slick-looking gauge program that purports to tell you how much memory and resources you are saving. We found its read-out to be questionable at best and misleading at worst.

The gauge displays totals for three types of memory: "Softram," "Hardram," and "Virtual Memory." It then adds these up to give you your total memory. There are a number of problems with this math. The first is that SoftRAM95 claims to create your Softram by compressing paged memory into a buffer in physical RAM; the default buffer size is claimed to be 25 percent of your physical memory. Therefore, right off the bat your Hardram could be only 75 percent of what Synchronys claims it to be. The second problem is that the program inevitably claims that the size of your Softram is the same as your Hardram, something that

DIALS AND GAUGES don't tell the whole story. Questionable calculations and "projections" instead of actual readings paint an inaccurate picture of your system's state.

loaded. We also found that actual free Windows resources, measured independently, remained the same in identical application test scenarios, whether SoftRAM95 was loaded or not. Synchronys countered by claiming that SoftRAM95 manages system resources only when they are very low. Our application script tested this by bringing system resources as low as 14 percent. The system still behaved the same with or without SoftRAM95. We asked Synchronys to provide us with further testing scenarios to demonstrate either RAM compression or Windows resource expansion. The company provided neither.

To manage memory below 1MB, SoftRAM95 has a program called SR-START that fragments conventional memory into numerous blocks of about 10K. The idea is that larger allocations will be forced into plentiful extended memory. One problem here is that if a larger allocation needs to be loaded into conventional memory, it will simply fail to load. Another is that smaller allocations will succeed in conventional memory with no problem. Also, SR-START loads via the load= line in win.ini. This means that most Windows device drivers, a prime source of wastage, will load before SR-START.

Synchronys is currently working on an update to SoftRAM95 that should be out by the time you read this. But we strongly recommend giving the current version a wide berth. □

SoftRAM95 2.0. List price: \$79.95. Synchronys Software, Culver City, CA; 800-808-0064. Circle 489 on reader service card.

Editors' note: As we went to press, Synchronys Software announced that it was recalling the current inventory of SoftRAM95 for credit or refund.

would require an improbably high 4:1 compression ratio.

The same gauge program also indicates the amount of Windows resources SoftRAM95 has saved you. Unfortunately, this number is not based on any actual measurement of savings (Synchronys conceded this, calling the read-out a "projection"). We found that the gauge displays the same numbers whether or not the two SoftRAM95

VxDs are actually

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By Jeff Prosize

The Right Tool for the Job

Unique uses for Windows 95's Find command that turn it into a weapon for power users.

Leave it to me to do everything the hard way. Recently I was browsing through some directories on my hard disk when I noticed that free space was down to 150MB. That seemed odd, because just a few weeks earlier there had been almost 400MB free. A closer inspection revealed that the culprit was a certain C++ compiler that uses prodigious amounts of disk space to store precompiled headers. I had lots of little software projects in the works at the time, and each project directory contained a 2MB-to-3MB .pch file eating up disk space.

The solution seemed simple: I didn't need all those .pch files anymore (the compiler will kindly regenerate them for you if you rebuild an application), so I set out to delete them from my hard disk. After popping in and out of about a dozen folders and dealing one .pch file after another a swift and deserving death, I realized there had to be a better way. In the old days, I'd have used my trusty old RDEL (recursive delete) utility to erase every .pch file on the drive with one command. Maybe it was time to write an RDEL utility for Windows—one that would make mass file deletions as simple as entering a file specification and clicking a button.

About the time I had everything laid out to begin yet another development project, another thought struck. Shouldn't there be a way to delete files spread throughout a hard disk using just the tools that Windows 95 provides? After all, the Windows 3.1 File Manager had an option for sweeping a hard disk and compiling a list of files that shared a common filename extension. And once the list was compiled, you could delete every file in the list in one stroke. Surely Windows 95 would do no less.

And therein lies a story. After a little ex-

perimenting, I discovered that I could use the Find command in the Start menu to perform surgical strikes on hard disk files, zapping certain files diskwide while leaving others untouched. I also found some other interesting uses for Find that hadn't occurred to me before. I had almost done things the hard way when a cleaner, quicker solution sat right under my nose.

DISKWISE FILE DELETIONS

Ridding a hard disk of unwanted files with Windows 95's Find command is a snap when the files share a common filename extension. Suppose, for example, you want to identify every .bak file on drive C: and delete some or all of them with a button click. Here's how to do it.

First, select Find from the Start menu and click Files or Folders. If you already have an Explorer window open, you can do the same thing by selecting Find from Explorer's Tools menu. In the Find window, type *.bak into the "Named" field on the "Name & Location" page and make sure the drive that you wish to search is selected in the "Look in" box. Make sure the "Include subfolders" box is checked, too. Then click the Find Now button to set the wheels into motion. Find will scour the drive you specified for .bak files and list each and every one of them as shown in Figure 1.

The rest is easy. Because the Find window is actually a view into the shell's namespace (the collection of drives, folders, files, printers, and other objects that represent the resources available on your computer), you can manipulate the objects that it displays the same way you manipulate objects in a My Computer or Explorer window. To delete every .bak file that Find found, press Ctrl-A to select the entire group. Then either press the Del key or drag the selection to the Recycle Bin. Remember that files transferred to the Recycle Bin won't save you any disk space until it is emptied. You can delete files immediately by dropping them on the Recycle Bin with the Shift key held down or by holding Shift and pressing the Del key while the files are selected.

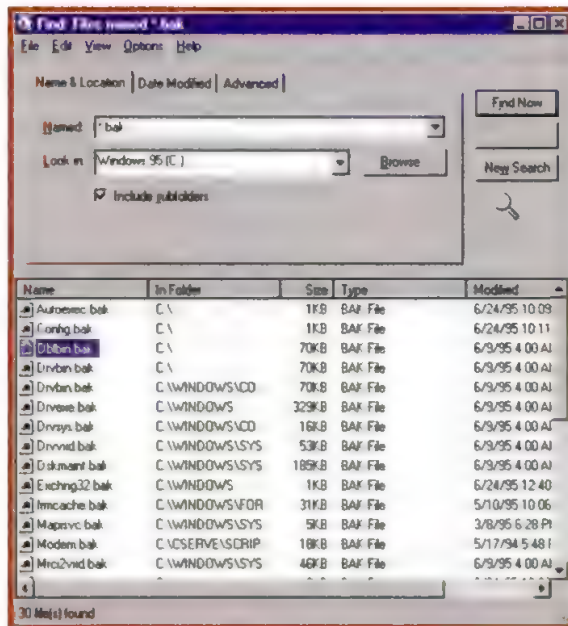


FIGURE 1: The Find window after a completed search.

FAST .ZIP FILE SEARCHES

Another job for which I've come to rely upon the Find command is searching for files stored inside .ZIP files. My hard disk is littered with .ZIP files containing compressed copies of files that may or may not still exist in uncompressed form. I was considering writing a ZipFind utility that would take a filename and search every .ZIP file on my

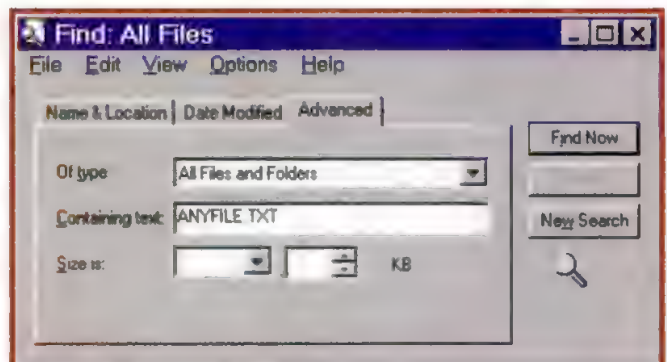


FIGURE 2: The Windows 95 Find utility lets you specify a text string and file size to narrow a search.

hard disk for an archived version of that file—then it occurred to me that Find would do it for me.

What? you say. Use Find to search for files inside .ZIP files? That's right. It's easy, and it works, because PKZIP stores the name of each file archived in a .ZIP file in plain text format, complete with the period separating the filename from the filename extension. The file's data is compressed, but its name is not. To quickly locate a .ZIP file that contains a file named ANYFILE.TXT, follow this simple procedure:

- Open the Find window and specify the drive you wish to search in the "Look in" box. Make sure "Include subfolders" is checked, too. Also be sure that "Case Sensitive" is not checked in Find's Options menu.

- Type *.ZIP into the "Named" box.

- Click the Advanced tab to display the advanced options page and type ANYFILE.TXT into the box labeled "Containing text" (see Figure 2).

- Click the Find Now button to start the search.

Find will now list for you all .ZIP files that contain copies of ANYFILE.TXT. And if you use the ZipView utility featured in our Utilities column of December 19, 1995, you can right-click any .ZIP file that Find displays and see what's inside it by looking at the property sheet's Contents page (see Figure 3).

Searching for archived files this way is comparatively fast, because Find has to open only files with the extension .ZIP. Find will often scan an entire hard disk in a matter of 10 to 15 seconds.

Note that you can't use wildcards in the "Containing text" field. Entering *.TXT, for example, won't find .ZIP files containing .TXT files, because Find will interpret the asterisk literally. But you *can* list all .ZIP files that contain compressed .TXT files by entering .TXT (with no asterisk) for the text string. And you can search for files named ANYFILE.* by simply entering ANYFILE.

If you search for a short string such as TXT, there's a slight (*very slight*) chance that you'll get a false match because three bytes in the file's compressed data happen to form the letters TXT. The longer the string you specify, the less likely Find is to report false matches. And since PKZIP stores filenames in all caps, you

can further decrease the likelihood of errors by spelling the filename in capital letters and setting Case Sensitive on.

DLL DEPENDENCIES

Another rather intriguing use that I've discovered for the Find command is determining whether it's safe to delete a certain DLL from my hard disk. DLLs, or *dynamic link libraries*, are special files that contain routines used by other Windows applications.

1. Open Find, then select the drive you wish to search and type the following line into the "Named" box:

.DLL;.EXE

(The semicolon allows you to search on more than one filename.) Once again, make sure the "Include subfolders" box is checked and the Options | Case Sensitive menu item is not.

2. Click the Advanced tab and type VISIOLIB in the "Containing text" box. Do not include the filename extension.

3. Click on Find Now.

Find will list for you all .EXE and .DLL files that contain the text VISIOLIB. If the search turns up empty, that's a pretty good clue that the DLL is no longer needed.

A pleasant side effect of searching executable files for DLL

names with Find is that Find will often succeed in identifying DLLs that are loaded explicitly by an application and are not therefore referenced in the file header. Even commercial uninstall applications typically won't succeed in hunting down this type of reference to a DLL. On the other hand, Find will occasionally turn up false matches, too, because it has no way of knowing whether a DLL name found in an executable file is used to load the DLL or to do something else such as display an error message.

ODDS AND ENDS

Use Find for a while and you'll discover other interesting things about it, too. Unlike the old Windows search command, it lets you search on any part of a filename. For example, searching on *par* will yield Clipart.doc.

You can search every drive on your PC by selecting "My Computer" in the "Look in" box rather than a drive name. If you take advantage of this feature, you may find it helpful to remove CDs from your CD-ROM drives before starting a search.

Two more enhancements not present in earlier versions of Windows are Find's ability to let you limit the search to files larger than or smaller than the size you specify and to specify dates and times.

I'm sure you'll find the Windows 95 Find utility a useful tool, and not just for the obvious file-searching tasks. □

Jeff Prorise is a contributing editor of PC Magazine.

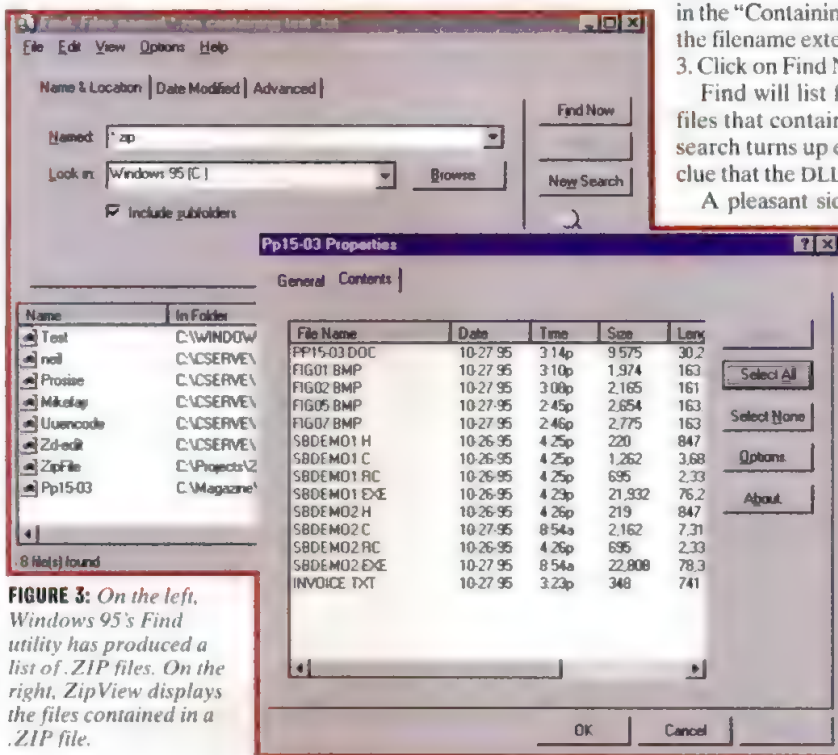


FIGURE 3: On the left, Windows 95's Find utility has produced a list of .ZIP files. On the right, ZipView displays the files contained in a .ZIP file.

Often, installing a new Windows application on your hard disk installs one or more DLLs, too. But most of the time it isn't obvious which DLLs go with which programs. Delete an application from your hard disk and you're liable to leave behind several DLLs that do little more than take up valuable disk space.

Most applications that rely on DLLs include information in their executable file headers that allows Windows to load the appropriate DLLs automatically when an application starts. Given the name of a DLL, you can use Find's text-search capability to determine whether the DLL is referenced. If Find fails to turn up a match, then it's relatively safe to assume that the DLL is no longer needed. To be safe, don't delete the DLL immediately. Instead, rename it or move it to a floppy disk and see if any of the applications that you run subsequently complain that they can't find the DLL.

Suppose you've found a copy of VISIOLIB.DLL (a file used by the Visio program) on your hard disk and you'd like to know whether you can get rid of it, since you uninstalled Visio. Here's how to go about it:

Our engineers blew out
a few pocket protectors
on this one.



Sam "Guru" Miller,
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By Jeff Prosise

Status Bars for Your Windows 95 Apps

A new standard control makes it easier to show users what they're doing.

One of the features that users have come to appreciate in Windows applications is the status bar. A status bar is a small frame along the bottom of an application's window that displays helpful information about current operation of the program. One use for a status bar is to display context-sensitive help for menu commands; another is to tell the user whether the application is currently in text-insert or overstrike mode. Some status bars even include progress meters that provide visual percent-complete feedback while lengthy operations are under way.

Microsoft Foundation Classes (Microsoft's C++ class library for Windows programming) makes status bars a snap with its handy `CStatusBar` class, but if you still write your applications the SDK way, status bars require a lot of work. In the past, you either needed a custom control or had to write the code yourself. Among other things, this meant that every status bar was implemented differently and no two looked exactly alike.

Windows 95 provides a standard status bar implementation in `Comctl32.dll`, otherwise known as the common controls library. Using a status bar common control is only a little more work than using `CStatusBar`. And it is immeasurably easier than writing the code yourself. Even if you're tempted to just cut and paste your old code, you should consider using the native implementation so that your application will look like other Windows 95 applications. And if your old code is 16-bit, this method will save you the trouble of porting it to 32 bits.

Let's start with a brief overview of how status bars work and the interfaces that Windows provides to them. Then we'll put together a pair of sample apps that demonstrate two very practical status bar implementations. You can download all source code and program files mentioned here from PC Magazine Online (see the sidebar "Guide to Our Utilities").

STATUS BAR BASICS

The first step in adding a status bar to your Windows 95 application is to `#include` the header file `Commctrl.h` and add `Comctl32.lib` to your list of linked libraries. Then add the following statement to your application's

`WM_CREATE` handler to make sure `Comctl32.dll` is loaded and initialized:

```
InitCommonControls ();
```

The next step is to add the code that creates the status bar. You can create a status bar in two ways: with the new `CreateStatusWindow` API function or with the trusty old `CreateWindow` or `CreateWindowEx`, passing it the class name `STATUSCLASSNAME`. `CreateStatusWindow` is the easier of the two methods, because it requires only four parameters: the status bar's style, text, parent, and control ID. The following statement creates a status bar that initially displays the text "Ready"; its

vide the status bar into three panes of approximately equal width:

```
RECT rect;
int nPaneWidth, nPanes[3];

GetWindowRect (h_wndStatusBar, &rect);
nPaneWidth = (rect.right
- rect.left) / 3;

nPanes[0] = nPaneWidth;
nPanes[1] = nPaneWidth * 2;
nPanes[2] = -1;

SendMessage (hwndStatusBar,
SB_SETPARTS, 3, (LPARAM) nPanes);
```

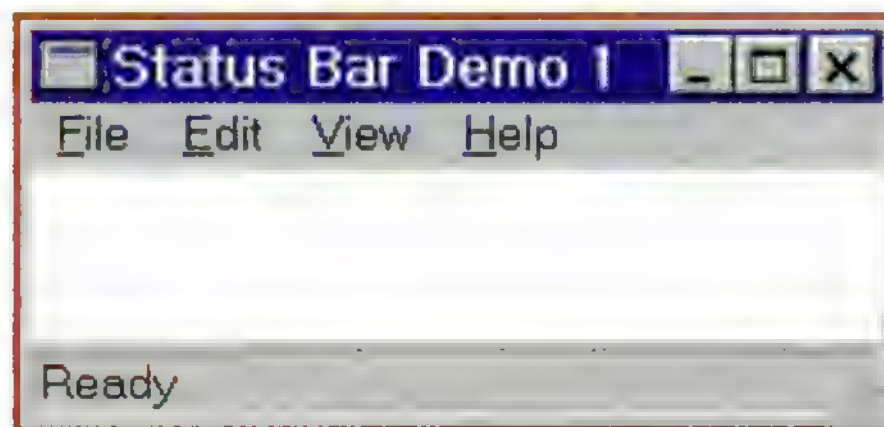


FIGURE 1: A simple status bar created with `CreateStatusWindow`.

parent is `hwndParent` and its ID is `IDC_STATUS_BAR`:

```
hwndStatusBar = CreateStatusWindow
(WS_CHILD | WS_VISIBLE, "Ready",
hwndParent, IDC_STATUS_BAR);
```

Figure 1 shows what the resulting status bar looks like. The status bar contains one panel, or *pane*, which is drawn with an indented 3-D look. The status bar automatically positions itself along its parent's bottom border (to place it at the top, you could add the style `CCS_TOP` to `WS_CHILD` and `WS_VISIBLE`), and it has a sizing grip at the right end—the treadlike lines drawn at 45-degree angles.

If this isn't the type of status bar that you want, you can customize it in a variety of ways. You can add panes (up to 255 of them) by sending the status bar `SB_SETPARTS` messages, and you can specify whether individual panes are drawn indented, flush, or protruding when you set the panes' text with `SB_SETTEXT` messages. The following statements di-

The `wParam` parameter that accompanies an `SB_SETPARTS` message specifies the number of panes. `lParam` points to an array of integers specifying the right pixel position of each pane. Specifying -1 for the rightmost pane tells the status bar that the final pane should extend all the way to the right border.

Individual panes in a multipane status bar are referenced by index. The leftmost pane is pane 0, the pane to the right of it is pane 1, and so on. Text is displayed in a pane by sending the status bar an `SB_SETTEXT` message specifying the text string, the pane index, and the pane style: indented, flush, or protruding. The following statements initialize a three-pane status bar with text identifying the pane numbers and styles:

```
SendMessage (hwndStatusBar,
SB_SETTEXT, 0, (LPARAM) "\tPane 0;
indented");

SendMessage (hwndStatusBar,
SB_SETTEXT, 1 | SBT_NOBORDERS,
(LPARAM) "\tPane 1; flush");

SendMessage (hwndStatusBar,
SB_SETTEXT, 2 | SBT_POPOUT, (LPARAM)
"\tPane 2; protruding");
```

The pane number and pane style are specified by ORing an index and an `SBT` identifier



FIGURE 2: This status bar shows pane numbering and styles.

together in the message's wParam parameter; omitting the SBT flag produces an indented pane. lParam contains a string pointer. Figure 2 shows what the resulting status bar looks like. The leading tab characters (\t) tell the status bar to center the text in the pane. Text that begins without a tab character is left-aligned, and text that begins with two tab characters is right-aligned.

SB_SETPARTS and SB_SETTEXT are probably the two most commonly used status bar messages, but there are others (see the table below). One of the most interesting is SB_SIMPLE, which toggles a status bar in and out of "simple" mode. Simple mode temporarily replaces all a status bar's panes with a single pane; toggling out of simple mode restores the original panes and their contents. One use for simple mode is to display context-sensitive help for menu items without dedicating a separate pane to do the job. Just switch to simple mode when a menu is pulled down, write help text to pane 0, and get out of simple mode when the menu is closed. That's what Word for Windows 7.0 does when it displays help for menu items. Switching in and out of simple mode is easy. The following statement switches to simple mode:

```
SendMessage (hwndStatusBar,
SB_SIMPLE, TRUE, 0);
```

And this statement switches out:

```
SendMessage (hwndStatusBar,
SB_SIMPLE, FALSE, 0);
```

One thing you must remember to do when using a status bar in a resizable window is to pass WM_SIZE messages to the status bar so that it can adapt to changes in the window size. Just include the following message handler in your window procedure:

```
case WM_SIZE:
    SendMessage (hwndStatusBar,
WM_SIZE, wParam, lParam);
    return 0;
```

With this handler in place, the status bar will automatically remain attached to the inside bottom border of its parent.

HELP TEXT FOR MENU ITEMS

Let's see how all this translates into code by writing a simple application that uses a single-pane status bar to display help text for menu items. The source code appears in Figure 3. SBDemo1's WM_CREATE handler creates the status bar with CreateStatusWindow, and its

WM_SIZE handler passes on sizing messages so the status bar will remain properly sized and positioned relative to its parent.

SBDemo1.rc contains the template for the application's menu, which includes four top-level menu items and associated pop-ups: File, Edit, View, and Help. The .rc file also includes a string table resource whose string IDs mirror the items in the menu template. The string table defines the help text for each

Remember: When using a status bar in a resizable window, pass WM_SIZE messages to the status bar so that it can adapt to changes in the window size.

menu item. The ID of the File | New menu item, for example, is IDM_FILE_NEW. You can find the corresponding help text ("Create a new document") by looking up IDM_FILE_NEW in the string table.

The glue that binds the help text to the status bar is SBDemo1.c's WM_MENUSELECT handler. Given the ID of the currently highlighted menu item, WM_MENUSELECT loads the associated string resource and displays it in the status bar with an SB_SETTEXT message. WM_MENUSELECT messages are sent when a top-level menu item is selected, when an item in a pop-up menu is highlighted, and when a menu is closed. The low word of

wParam contains the menu item ID if the message pertains to a pop-up menu item or it contains the menu item index if the message pertains to an item in a top-level menu. The high word contains bit flags with additional information about the item.

SBDemo1's WM_MENUSELECT handler first checks to see whether the high word of wParam equals 0xFFFF and lParam equals 0, which indicates that the menu was just closed. The handler's response is to redisplay the "Ready" string:

```
uItem = LOWORD (wParam);
fuFlags = HIWORD (wParam);

if ((fuFlags == 0xFFFF) &&
(lParam == 0))
    SendMessage (hwndStatusBar,
SB_SETTEXT, 0, (LPARAM) "Ready");
```

It next attempts to correlate the value of uItem with the ID of a menu item and displays the corresponding string if a match is found. SBDemo1's menu items are assigned consecutive IDs from 100 to 114 to make the comparison easy:

```
else if ((uItem >= IDM_FILE_NEW) &&
(uItem <= IDM_HELP_ABOUT)) {
    LoadString (hInstance, uItem,
szHelpText, sizeof (szHelpText));
    SendMessage (hwndStatusBar,
SB_SETTEXT, 0, (LPARAM)
szHelpText);
}
```

If neither of the above tests proves positive, the handler displays a null string. This takes care of the case when a top-level menu item is clicked or when the highlight is over a separator bar in a pop-up menu:

```
else
    SendMessage (hwndStatusBar,
SB_SETTEXT, 0, (LPARAM) "");
```

STATUS BAR MESSAGES

Message	Description
SB_GETBORDERS	Retrieves the width of the status bar, the top, bottom, left, right, and between panes.
SB_GETPARTS	Retrieves the number of panes in a status bar and the position of each pane's right edge.
SB_GETRECT	Retrieves a pane's bounding rectangle.
SB_GETTEXT	Retrieves a pane's text and style.
SB_GETTEXTLENGTH	Retrieves the length of a pane's text.
SB_SETMINHEIGHT	Sets the minimum height of the status bar's panes.
SB_SETPARTS	Sets the number of panes and each pane's width and position.
SB_SETTEXT	Sets a pane's text and style.
SB_SIMPLE	Toggles a status bar in and out of "simple" mode.

You can judge the results for yourself by pulling down one of SBDemo1's menus and watching the status bar as you move the cursor up and down, as shown in Figure 4.

The only menu item that is functional is View | StatusBar, which toggles the status bar on and off. The WM_COMMAND handler that makes it work is very simple. It first calls IsWindowVisible to find out whether the status bar is currently visible. It

```

//*****
//
//  SBDemo1.h
//
//*****

#define IDC_STATUS_BAR          100

#define IDM_FILE_NEW            100
#define IDM_FILE_OPEN           101
#define IDM_FILE_SAVE           102
#define IDM_FILE_SAVE_AS        103
#define IDM_FILE_PRINT           104
#define IDM_FILE_PRINT_PREVIEW  105
#define IDM_FILE_PRINT_SETUP     106
#define IDM_FILE_EXIT            107

#define IDM_EDIT_UNDO            108
#define IDM_EDIT_CUT             109
#define IDM_EDIT_COPY            110
#define IDM_EDIT_PASTE           111

#define IDM_VIEW_TOOLBAR         112
#define IDM_VIEW_STATUS_BAR      113

#define IDM_HELP_ABOUT           114
//*****
//
//  SBDemo1.c
//
//*****

#include <windows.h>
#include <commctrl.h>
#include "SBDemo1.h"

LRESULT CALLBACK WndProc (HWND, UINT, WPARAM, LPARAM);

int WINAPI WinMain (HINSTANCE hInstance, HINSTANCE
hPrevInstance,
                LPSTR lpszCmdLine, int nCmdShow)
{
    static char szWndClass[] = "SBDemo1";
    WNDCLASS wc;
    HWND hwnd;
    MSG msg;

    wc.style = 0;
    wc.lpfnWndProc = (WNDPROC) WndProc;
    wc.cbClsExtra = 0;
    wc.cbWndExtra = 0;
    wc.hInstance = hInstance;
    wc.hIcon = LoadIcon (NULL, IDI_APPLICATION);
    wc.hCursor = LoadCursor (NULL, IDC_ARROW);
    wc.hbrBackground = (HBRUSH) (COLOR_WINDOW + 1);
    wc.lpszMenuName = "MainMenu";
    wc.lpszClassName = szWndClass;

    RegisterClass (&wc);

    hwnd = CreateWindow (szWndClass, "Status Bar Demo 1",

```

```

WS_OVERLAPPEDWINDOW, CW_USEDEFAULT,
CW_USEDEFAULT, CW_USEDEFAULT,
CW_USEDEFAULT, HWND_DESKTOP, NULL, hInstance,
NULL);

ShowWindow (hwnd, nCmdShow);
UpdateWindow (hwnd);

while (GetMessage (&msg, NULL, 0, 0)) {
    TranslateMessage (&msg);
    DispatchMessage (&msg);
}
return msg.wParam;
}

LRESULT CALLBACK WndProc (HWND hwnd, UINT message, WPARAM
wParam,
                        LPARAM lParam)
{
    HMENU hMenu;
    static HINSTANCE hInstance;
    static HWND hwndStatusBar;
    UINT uItem, fuFlags;
    char szHelpText[64];

    switch (message) {

    case WM_CREATE:
        //
        // Create the status bar.
        //
        InitCommonControls ();
        hwndStatusBar = CreateStatusWindow (WS_CHILD |
WS_VISIBLE,
        "Ready", hwnd, IDC_STATUS_BAR);

        hInstance = ((LPCREATESTRUCT) lParam)->hInstance;
        return 0;

    case WM_SIZE:
        //
        // Echo WM_SIZE messages to the status bar.
        //
        SendMessage (hwndStatusBar, WM_SIZE, wParam,
lParam);
        return 0;

    case WM_MENUSELECT:
        //
        // Update the status bar as the user browses the
        // menus.
        //
        uItem = LOWORD (wParam);
        fuFlags = HIWORD (wParam);

```



(continues)

FIGURE 3: The C++ source code that produces the sample app shown in Figure 4.


```

if ((fuFlags == 0xFFFF) && (lParam == 0))
    SendMessage (hwndStatusBar, SB_SETTEXT, 0,
        (LPARAM) "Ready");

else if ((uItem >= IDM_FILE_NEW) && (uItem <=
IDM_HELP_ABOUT)) {
    LoadString (hInstance, uItem, szHelpText,
        sizeof (szHelpText));
    SendMessage (hwndStatusBar, SB_SETTEXT, 0,
        (LPARAM) szHelpText);
}

else
    SendMessage (hwndStatusBar, SB_SETTEXT, 0,
        (LPARAM) "");

return 0;

case WM_COMMAND:
    //
    // Process menu selections.
    //
    switch (LOWORD (wParam)) {

case IDM_VIEW_STATUS_BAR:
    //
    // Display or hide the status bar.
    //
    hMenu = GetMenu (hwnd);

    if (IsWindowVisible (hwndStatusBar)) {
        ShowWindow (hwndStatusBar, SW_HIDE);
        CheckMenuItem (hMenu, IDM_VIEW_STATUS_BAR,
            MF_UNCHECKED);
    }
    else { // Not visible
        ShowWindow (hwndStatusBar, SW_SHOW);
        CheckMenuItem (hMenu, IDM_VIEW_STATUS_BAR,
            MF_CHECKED);
    }
    return 0;
}
break;

case WM_DESTROY:
    //
    // Terminate the application.
    //
    PostQuitMessage (0);
    return 0;
}

return DefWindowProc (hwnd, message, wParam, lParam);
}
//*****
//
// SBDemo1.rc
//
//*****
#include "SBDemo1.h"

```

```

MainMenu MENU
BEGIN
    POPUP "&File" {
        MENUITEM "&New\tCtrl+N",        IDM_FILE_NEW
        MENUITEM "&Open...\tCtrl+O",    IDM_FILE_OPEN
        MENUITEM "&Save\tCtrl+S",        IDM_FILE_SAVE
        MENUITEM "Save &As...",          IDM_FILE_SAVE_AS
        MENUITEM SEPARATOR
        MENUITEM "&Print...\tCtrl+P",    IDM_FILE_PRINT
        MENUITEM "Print Pre&view",       IDM_FILE_PRINT_PREVIEW
        MENUITEM "P&rint Setup...",      IDM_FILE_PRINT_SETUP
        MENUITEM SEPARATOR
        MENUITEM "&Exit",                IDM_FILE_EXIT
    }
    POPUP "&Edit" {
        MENUITEM "&Undo\tCtrl+Z",        IDM_EDIT_UNDO
        MENUITEM SEPARATOR
        MENUITEM "Cu&t\tCtrl+X",          IDM_EDIT_CUT
        MENUITEM "&Copy\tCtrl+C",         IDM_EDIT_COPY
        MENUITEM "&Paste\tCtrl+V",        IDM_EDIT_PASTE
    }
    POPUP "&View" {
        MENUITEM "&Toolbar",              IDM_VIEW_TOOLBAR
        MENUITEM "&Status Bar",          IDM_VIEW_STATUS_BAR, CHECKED
    }
    POPUP "&Help" {
        MENUITEM "&About SBDemo1...",    IDM_HELP_ABOUT
    }
END

STRINGTABLE
BEGIN
    IDM_FILE_NEW        "Create a new document"
    IDM_FILE_OPEN        "Open an existing "document"
    IDM_FILE_SAVE        "Save the current "document"
    IDM_FILE_SAVE_AS     "Save the current
                        "document with a new name"
    IDM_FILE_PRINT       "Print the current document"
    IDM_FILE_PRINT_PREVIEW "Preview the printed
                        "document"
    IDM_FILE_PRINT_SETUP "Change printing options"
    IDM_FILE_EXIT        "Exit the application"
    IDM_EDIT_UNDO        "Undo the last action"
    IDM_EDIT_CUT         "Remove the current
                        "selection and copy it to
                        "the clipboard"
    IDM_EDIT_COPY        "Copy the current
                        "selection to the
                        "clipboard"
    IDM_EDIT_PASTE       "Paste the clipboard's
                        "contents into the current
                        "document"
    IDM_VIEW_TOOLBAR     "Show or hide the toolbar"
    IDM_VIEW_STATUS_BAR  "Show or hide the status
                        "bar"
    IDM_HELP_ABOUT       "Display information about
                        "this program"
END

```

FIGURE 3: (CONT.)

then uses ShowWindow to show or hide the status bar and CheckMenuItem to check or uncheck the menu item.

A MORE COMPLEX STATUS BAR

SBDemo1 is pretty good for a start, but there's plenty more you can do. The SBDemo2 application expands on SBDemo1 with a multipane status bar that displays menu help in pane 0, which is painted flush rather than indented, and the current states of CapsLock, NumLock, and ScrollLock in indented panes at the right end of the status bar. It also demonstrates how one can better blend the status bar with the window border by bordering the window's effective client area—the client area minus the space occupied by the status bar—with a sunken WS_EX_CLIENTEDGE-style rectangle. The new WS_EX_CLIENTEDGE style is used in Windows 95 dialog boxes to give controls an indented 3-D look. And MFC uses it to border view windows that serve as “containers” for data. The source code for SBDemo2 is available for downloading from PC Magazine Online. Figure 5 shows the SBDemo2 window.

After creating the status bar in the WM_CREATE handler, SBDemo2 calls a local function named InitStatusBar to initialize it. InitStatusBar sends an SB_SETPARTS message to split the status bar into four panes, followed by four SB_SETTEXT messages to set the panes' sizes, positions, and initial text. Information concerning the CapsLock, NumLock, and ScrollLock states is obtained with Windows' GetKeyboardState function, which copies a 256-byte array with data representing individual key states to a local buffer. The zeroth bits of the VK_CAPITAL, VK_NUMLOCK, and VK_SCROLL members of the array are set if CapsLock, NumLock, and ScrollLock are on, and clear if they are not. Note the use of tab characters to center the strings “Caps,” “Num,” and “Scroll” in their respective panes. The “Ready” displayed in pane 0 is left-aligned because it is not preceded by a tab character.

The menu help text in pane 0 is updated by the window procedure's WM_MENUSELECT handler, just as it was in SBDemo1. Panes 1, 2, and 3 are updated by the WM_KEYDOWN handler, which senses presses of the CapsLock, NumLock, and ScrollLock keys. When any one of these keys is pressed, the handler uses GetKeyState to determine the new toggle state and sets the status bar text accordingly.

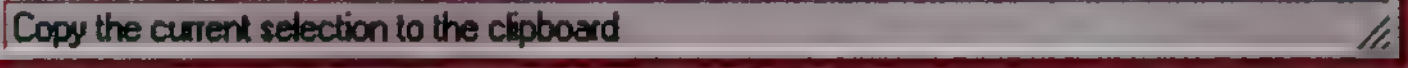


FIGURE 4: SBDemo1 shows an explanatory message about the current menu selection.

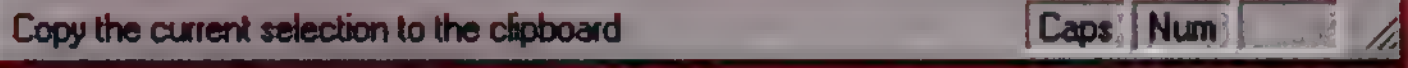


FIGURE 5: The SBDemo2 window is somewhat more advanced: It shows the status of the CapsLock and NumLock keys, and its message is level with the main window's border.

The panes are sized and positioned by the local PositionPanels function, which is called from the WM_SIZE handler so the three rightmost panes will remain in the same position relative to the right end of the status bar when the window size changes. It's important to call PositionPanels *after* passing the WM_SIZE message to the status bar or else the status bar's size will not have changed. The first WM_SIZE message arrives before the window is displayed for the first time, so the window's WM_CREATE handler need not call PositionPanels separately.

PositionPanels uses an SB_SETPARTS message to configure the status bar's panes. The size and location of each pane is based on the average width of a character in the status bar font, which defaults to 8-point MS Sans Serif. The font handle is obtained with a WM_GETFONT message. The font is then selected

into a temporary device context, and GetTextMetrics is called to determine the average character width. Basing pane sizes and locations on the status bar font in this manner ensures that the panes' relative proportions will remain the same even if the screen metrics vary. Hardcoded pixel counts might work okay at resolutions of 640 by 480 and 1,024 by 768, but one day when

we're all running Windows at 2,048 by 2,048, you'll be glad you tied your status bar's pane size to the font size. And should the default status bar font ever change, your code will adjust the panes automatically.

A final aspect of SBDemo2 to consider is the code in the WM_PAINT handler that draws the sunken window border:

```
GetModifiedClientRect (hwnd,
    hwndStatusBar, &rect);
DrawEdge (hdc, &rect, EDGE_SUNKEN,
    BF_RECT);
```

GetModifiedClientRect is a local function that computes the effective client-area rectangle by subtracting the height of the status bar from the rectangle returned by GetClientRect. DrawEdge is a new Win32 function that draws edges in a variety of styles. The combi-

nation of EDGE_SUNKEN and BF_RECT draws a complete rectangle with a WS_EX_CLIENTEDGE-style edge.

An alternative to drawing the edge yourself is to do as MFC does and overlay the window's effective client area with a WS_CHILD view window that also has the style WS_EX_CLIENTEDGE. The edge is then drawn automatically, but your code must be rewritten so that input is either processed by the view's window procedure or passed upward for the main window to handle. The main window must also take care to resize the view window when the window size changes.

One final difference between SBDemo1 and SBDemo2 is the code that handles View | Status Bar commands, which has been modified to ensure that the window edge is redrawn properly when the status bar is shown or hidden. After toggling the status bar's visibility on or off, the handler invalidates a few rows of pixels at the bottom of the window so the corresponding portion of the border will be redrawn, too.

EXERCISES FOR THE READER

If you'd like to learn more about Windows 95 status bars, try modifying the sample code to implement these features:

- A status bar pane that contains a progress control. It's easy to do: Create the pane with an SB_SETPARTS message and use an SB_GETRECT message to get the corresponding rectangle. Then create a progress control in the rectangle and reparent it with SetParent so that the status bar, and not the application's main window, is the control's parent. This will bind the two together so that when the status bar moves, the progress control will move with it.
- CapsLock, NumLock, and ScrollLock indicators that display grayed text instead of null strings when the corresponding keyboard state is off. Hint: Another style that can be passed in an SB_SETTEXT message is SBT_OWNERDRAW, which creates an owner-drawn pane. You can trap WM_DRAWITEM messages and draw whatever you like in an owner-drawn pane, including grayed text.

For further information regarding status bars and status bar messages, refer to the Windows 95 SDK. □

Jeff Prosise is a contributing editor of PC Magazine.

The new
WS_EX_CLIENTEDGE
style is used in
Windows 95 dialog boxes
to give controls an
indented 3-D look.



PC Tech/Utilities

By Richard Dragan

Warp Cabinet: An OS/2 Filer

Copy, move, and rename files in OS/2 Warp with a File Manager-like window.

Although IBM's OS/2 Warp is a powerful operating system, its Drives tool facility for managing files is a bit awkward to use. Each drive is a separate object, and to see the contents of a folder, you must open a separate window. The window that displays files is not updated when you move down the folder list with the cursor; you have to open a separate window for each folder. You could use the Windows 3.1 File Manager through Win-OS/2, but it doesn't support HPFS long filenames.

This issue's utility, Warp Cabinet, gives you another option. It lets you view, copy, move, and rename files using an interface that is similar to the Windows 3.1 File Manager. It can also display multiple drives in a single window the way the Windows 95 Explorer can. You can obtain Warp Cabinet and its C++ source code by downloading it from PC Magazine Online or by mail. (For details, see the sidebar "Guide to Our Utilities.") To compile Warp Cabinet from the source code, you'll need Borland C++ for OS/2, Version 2.0 or later.

USING WARP CABINET

To install Warp Cabinet, copy the files WARP-CAB.EXE and WARPCAB.INI into any directory on your hard disk. The directory need not be in your DOS PATH command, but both files must be in the same directory. Then add an icon for Warp Cabinet to your OS/2 desktop by dragging a Program template (from the Templates folder) to the folder where you'd like to place Warp Cabinet. Set the pathname and filename on the Program page to point to WARPCAB.EXE. Then go to the General page and change the title to Warp Cabinet.

When you launch Warp Cabinet, you'll see a dual-pane window, as shown in Figure 1.

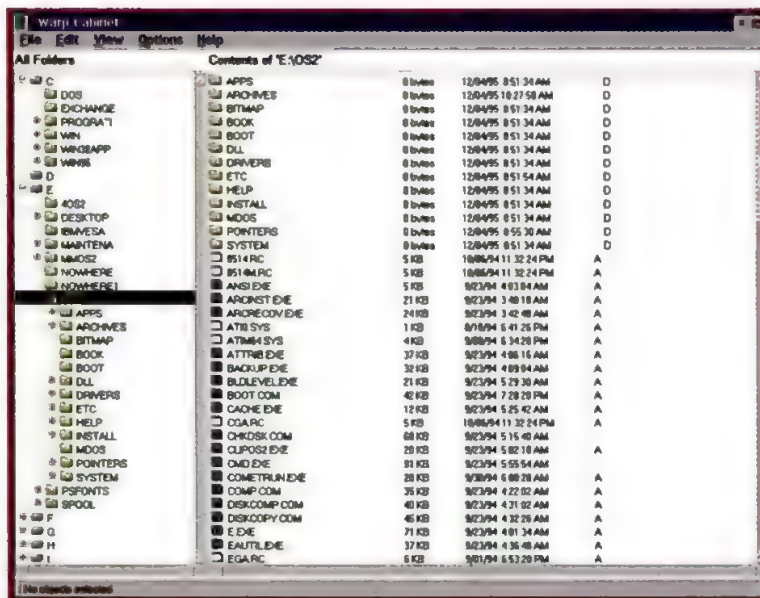


FIGURE 1: Warp Cabinet is a file management utility for OS/2 Warp that combines features of the Windows 3.1 File Manager and the Windows 95 Explorer.

Your installed drives and directories appear in the All Folders list in the left pane. The contents of the highlighted folder are displayed in the right pane. You can adjust the size of each pane by positioning the cursor between the panes and dragging with the mouse.

To select a disk drive from the folder list, use the left mouse button or the cursor keys. When you select a drive, the contents of that

drive will appear in the file list on the right. When a disk drive or folder in the left pane is marked with a plus sign, it means that that folder contains other folders. To expand the tree, single-click on the plus sign or double-click on the folder. Once a directory has been expanded, it's marked with a minus sign. You can recollapse a directory by single-clicking

on the minus sign or double-clicking on the folder.

The View menu lets you choose what information to display about a file. You can display just the filename, or you can add file size, date and time of last modification, and file attributes. If you select the Partial Details option, a dialog box will appear that lets you select what information to display (see Figure 2).

If you don't want to view every type of file on your drives, you can choose Show File Types... from the View menu. A dialog box will appear that lets you type in a DOS-style mask (for example, *.DOS) and choose whether or not to display files with system or hidden attributes (see Figure 3).

The last items under the View menu are the sorting options. Warp Cabinet lets you sort files alphabetically by name, type (file extension), size (largest first), or date. When you select a sort option, a check mark appears next to it.

In addition to browsing, Warp Cabinet lets you move, copy, and delete files. To use these features, select some files to work with. The file list in the right pane allows multiple selections. The number of objects and their total size will be updated at the bottom of the window as you work. To select (or deselect) a group of files by file mask, you can use the Edit/Select Files... menu option. To quickly select or deselect all the files in an open folder, use the Select All or Clear Selections options under the Edit menu.

You can move selected files by dragging them to the desired folder in the left pane and dropping them. As with the Windows 95 Explorer, you don't need two open windows to move files between disk drives. Just make sure your desired target folder is displayed in the Folder List on the left.

IN THIS ISSUE

Warp Cabinet

Warp Cabinet is an OS/2 Warp file management utility with an interface similar to the Windows 3.1 File Manager, but it can also display multiple drives in a single window like the Windows 95 Explorer.



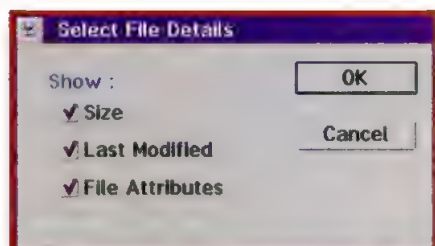


FIGURE 2: Warp Cabinet lets you choose which file details to view. You can display file size, date and time of last modification, and file attributes.

Copying files is accomplished in much the same way. If you hold down the Ctrl key while you drag-and-drop a file, the file will be copied rather than moved. This corresponds to the way the OS/2 Drives tool works.

Although it's convenient, you don't always have to use drag-and-drop to copy or move files. File menu commands let you accomplish these same tasks. First highlight some files, then select Move/Rename..., Copy..., or Delete from the File menu. If you're moving or copying files, a dialog box will appear, letting you choose your file destination. Warp Cabinet supports the wildcard characters "?" and "*", as well as OS/2 HPFS long filenames.

Warp Cabinet's default setting will ask you for confirmation before deleting, overwriting, or copying a file. You can change this by selecting Confirmation... from the Options menu (see Figure 4). Confirmations apply to both drag-and-drop and menu-initiated operations.

Warp Cabinet also allows you to manipulate the attributes of files. To do this, select a file or group of files and choose the File | Properties menu option. A dialog box will let you select any combination of file attributes, such as system, hidden, read-only, or archive. Another File menu command, Create Directory..., lets you create new folders without leaving Warp Cabinet. (The OS/2 Drives tool does not have a facility for creating new directories.)

If you double-click on an executable file in the right-hand pane, Warp Cabinet will run it for you. Alternatively, you can select the file and choose Open from the File menu. For document files (any file that is not an executable), you can set up associations with the programs that manage them. Double-clicking on a document or selecting File | Open will then launch the necessary program. Some associations are set up automatically—for in-

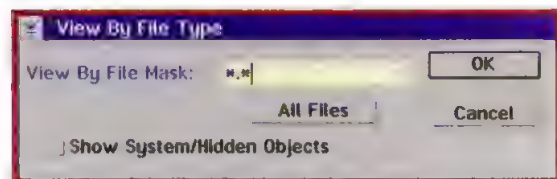


FIGURE 3: To view only those files that match a DOS-style mask, choose Show File Types... from the View menu.

stance, .TXT files are associated with the PM text editor EPM.EXE. To set up new associations, select File | Associate...; you'll see a dialog box where you can enter the new file type and its associated executable (see Figure 5). Associations are saved in WARPCAB.INI so that they remain available when you exit and restart Warp Cabinet.

The File | Run menu option lets you execute a command line without leaving Warp Cabinet. As with File Manager, the current file selection is copied into the command line edit box. If you have multiple selections, only the first is copied to the edit box.

Warp Cabinet does not include a Print command; it relies on OS/2 Warp for this feature. To print a file, simply drag it over to the OS/2 Printer icon and drop it. (Printing works only for text files.)

You can also drag files from Warp Cabinet to other programs that accept filenames for input. Use the right mouse button to drag one or more selected files to the other window. Remember, however, that you can't drag-and-drop files onto Warp Cabinet.

Finally, I'd like to add a note about floppy disks, CD-ROM drives, and network drive mappings. At start-up, Warp Cabinet checks for all available drives from A: to Z:, but it will not see drives that don't have valid media already in place. So if you add a CD-ROM to a previously empty CD-ROM drive, or if you map a new network drive, you'll need to select Options | Refresh All Folders to update the display.

INSIDE WARP CABINET

Warp Cabinet relies on the power of a C++ application framework, Borland's Object Windows Library (OWL) for OS/2, which ships with Borland C++ for OS/2, Version 2.0. OWL can manage most of Warp Cabinet, but there are plenty of times when knowledge of the OS/2 API is needed.

OWL was originally written for the Windows platform, and the OS/2 version uses the same calls. This makes porting programs between Windows and OS/2 much easier. OWL translates Windows-style messages and C/C++ typedefs into their OS/2 equivalents. This information is stored in PMWINDOW.H, in the \OWL\INCLUDE directory of the Borland C++ compiler. You'll

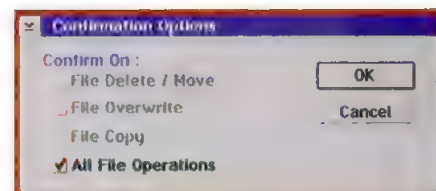


FIGURE 4: The confirmation dialog box under the Options menu lets you choose which actions Warp Cabinet asks you to confirm.

find that some Windows functions don't have equivalents in OS/2, but most do. When writing programs with OWL for OS/2, you can actually use Windows names for common data types and messages, because they are aliased for their OS/2 counterparts.

Warp Cabinet uses objects based on the standard OWL class TListBox for its left and right panes—FolderList on the left and

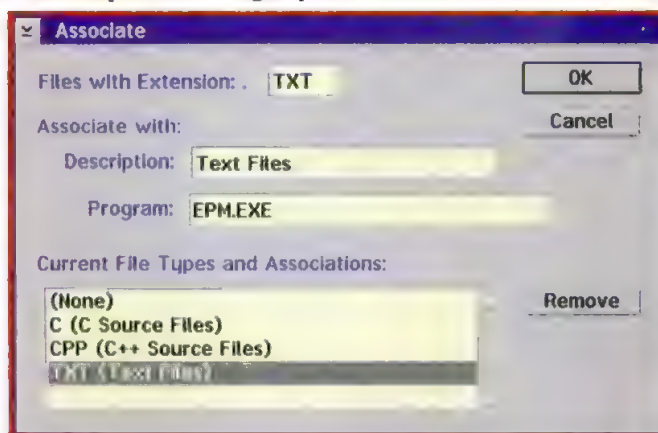


FIGURE 5: The File | Associate dialog box lets you associate file types with the programs that manage them.

FileList on the right. But these two list boxes have been modified to resemble two new controls available to Windows 95 programmers: TreeView and ListView.

An advantage of both TreeView and ListView is that they let you easily display icons next to text descriptions. The TreeView control, which can manage hierarchical lists such as subdirectory trees with very little work, is used in the left pane of the Windows 95 Explorer. The right pane of Explorer uses the ListView control.

In OS/2, the Container control provides similar functionality. I could have used this control (which is used in the Drives tool) in Warp Cabinet, but instead I chose to demonstrate how programmers can achieve the same functionality with a different look by using the "owner-draw" style.

I took over the work of drawing these controls (using the DFrame::SetupWindow() method in WARPCAB.CPP) by turning on the LBS_OWNERDRAWFIXED style bit. OWL for OS/2 translates this Windows style bit into its OS/2 equivalent, LS_OWNERDRAW. By setting this owner-draw style bit, I told the sys-


```
typedef struct _TREEVIEW_ITEM
{
    int nListBoxIndex; // Index # of this entry.
    int nLevel;        // In hierarchical list, this is the level of this
                        // entry
    int nExpandCode;   // 0 = Nothing to expand, 1 == Can Expand [+], 2
                        // Already Expanded [-]
    int bIsEndOfLevel;
    LPSTR Parent;      // Our parent's index on hierarchy, (NULL) for root entries
    int iImage;
    int iSelectedImage;
    LPSTR lpszDirText;
    int nTextLen;
} TREEVIEW_ITEM;
```

FIGURE 6: The `TREEVIEW_ITEM` structure stores information needed to mimic the functionality of the Windows 95 TreeView custom control, including image information.

tem that Warp Cabinet would be doing the work of drawing the items in these two list-box controls.

That was only the beginning, of course—the real work was yet to come. First, I defined two structures that would hold everything necessary for both types of lists. Figure 6 shows the `TREEVIEW_ITEM` structure, which contains the fields required to manage the hierarchical list used in the FolderList list box. The `nExpandCode` field tells whether a particular branch of the list can be expanded. If so, Warp Cabinet displays a plus sign. Once a node is expanded, the plus sign is changed to a minus sign. Branches that contain no additional subdirectories get neither.

The `iImage` and `iImageSelected` fields contain indexes into an array of bitmapped images called `ImageList`. Each `TBitmap` object contains a 16-by-16 pixel image that serves as the graphical companion to the list box item text. This technique lets Warp Cabinet associate different images with each type of directory or file. It also lets Warp Cabinet display a different image when an item is selected—for example, an open folder instead of a closed folder.

The necessary hierarchical information is stored in two fields: `nLevel` and `pParent`. The `nLevel` field tracks the current level of the hierarchy—that is, the number of subdirectories down in a disk drive. A value of 1 is used to describe the root directory of a disk, and the number is increased from that point. The `pParent` field stores the name of the next subdirectory up in the hierarchy. This lets Warp Cabinet construct the path to a file by walking up the directory tree from a particular directory.

The list box control manages the information in the data structure. List boxes store two pieces of information: a 32-bit data value and a string value. String values are typically set to the displayed text description (in this case, the filename); Warp Cabinet, however, stores the filename in the `TREEVIEW_ITEM` data

structure and sets the string value to “NA”. This lets Warp Cabinet reconstruct the fully qualified filename regardless of whether the item is displayed. (The list box string value is set to “NA” rather than null because

```
// FILEENTRY.H -- Simple class to manage files in listboxes.
#ifndef _FILEENTRY_H
#define _FILEENTRY_H

const int SORT_BY_NAME = 0;
const int SORT_BY_DATE = 1;
const int SORT_BY_EXT = 2;
const int SORT_BY_SIZE = 3;

class FILEENTRY
{
public:
    static int nSortMethod; // Change this member to change the sort method
                           // used to store file entries.

    long lFileSize;
    unsigned long ulFileAttrib;
    unsigned short uFileTime;
    unsigned short uFileDate;
    char szFileName[256];
    char szExt[4]; // File Extension
    int nType;
    int iImage;

    FILEENTRY(struct ffb1k& FileInfo, BOOL bIsDir, int nMySortMethod =
        SORT_BY_NAME);

    // In order to use this class with a template-based container,
    // we need to define < and == operators. (Note this isn't a full-fledged
    // class.)
    int operator<(const FILEENTRY& CompareItem);

    int operator==(const FILEENTRY& CompareItem);
};

#endif
```

FIGURE 7: The `FILEENTRY` class tracks information about each file or directory entry in the `FileList` list box.

it must contain a value to create the item.)

The list box data value, on the other hand, is very useful to Warp Cabinet. In the FolderList control, I used this 32-bit value to point to the `TREEVIEW_ITEM` record that contains the attributes of each item in the control.

There's no need to store as much information for the `FileList` list box, since there's no hierarchical information and only a single image is used for each file entry (regardless of whether it is selected). For the `FileList` list box, I used a simple class named `FILEENTRY` (declared in `FILEENTRY.H`) to track information about each file or directory entry, such as filename, size, attributes, or time stamp (see Figure 7).

The next step was the drawing itself. There are two messages that must be supported in order to maintain owner-drawn lists. The `WM_MEASUREITEM` message (which is intercepted by the `EvMeasureItem()` event handler from within `OWL`) is easy to support. This event is sent by the operating system whenever the height of an item is required. In Warp

Cabinet, I find that a fixed height of 18 pixels for each item makes the drawing easier.

The other operating system event, WM_DRAWITEM, is sent whenever an item needs to be displayed. The information needed for drawing is stored in an OS/2 data structure called OWNERITEM. In

this case, you cannot use the Windows structure name, DRAWITEMSTRUCT, because this structure is not aliased to point to OWNERITEM.

OWNERITEM is defined in the OS/2 header file PMWIN.H. To access this data structure, I first tried including the main OS/2 header file, OS2.H, but this caused conflicts within OWL: OWL already redefines many data types and definitions so that it can translate Windows classes and data types into OS/2. The solution I found was to collect the low-level OS/2 API prototypes and definitions from individual OS/2 header files

THE TOP 10 UTILITIES

- 1 **WORDJUNCTION** Creates word puzzles
- 2 **STRING** Batch file enhancer
- 3 **1MBF** Protects low memory
- 4 **WMATCH** Compares directory contents
- 5 **WINBAR** Taskbar for Windows 3.1
- 6 **INCTR2** Monitors program installation
- 7 **FDDLLS** Finds dead DLLs
- 8 **SUPERPAD** Improved Windows notepad
- 9 **COA** Program location notifier
- 10 **FINDIR** Analyzes IRQ lines

and place them in a single file named OS2APLH. This approach allowed me to make OS/2 API calls directly, while still using OWL classes.

File entries are drawn in the DFrame::DrawItem procedure. First, I retrieved the pointer to the FILEENTRY record using TListBox::GetItemData(). Using a background brush, I erased the rectangle in which the entry would be drawn, then used the DFrame::DrawImage() method to draw the image in the iImage variable. I selected a memory device context (in this case, the

iImage variable), then copied it to the screen using bit-block transfers, or BitBlt.

Next, I displayed the name of each file using a custom font. Depending on the OWNERITEM.fsState field, I drew each entry either "normally" or highlighted. Depending on the options selected,

Warp Cabinet displays the file size, time stamp, and attribute fields after the filename.

Warp Cabinet provides file-handling capabilities in a format that is easier to work with than the OS/2 Drives tool. It also demonstrates how owner-drawn controls can be used to update the appearance and functionality of standard controls. □

Richard Dragan is a programmer for PC Magazine Labs and teaches C++ at Columbia University.

GUIDE TO OUR UTILITIES

ABOUT WARP CABINET...

PURPOSE: Warp Cabinet is an OS/2 Warp file management utility that is easier to use than the Drives tool included with OS/2. Its interface is similar to the Windows 3.1 File Manager, but it can display multiple drives in a single window like the Windows 95 Explorer.

USAGE: To install Warp Cabinet, copy the files WARPCAB.EXE and WARPCAB.INI to a directory on your hard disk. The directory need not be in your DOS PATH, but both files must be in the same directory. Then add an icon for Warp Cabinet to your OS/2 desktop.

When you launch Warp Cabinet, you'll see a dual-pane window. Your installed drives and directories appear in the All Folders list in the left pane. The contents of the highlighted folder are displayed in the right pane.

You can move selected files by dragging them to the desired folder in the left pane and dropping them. To copy files, hold down the Ctrl key when you drag-and-drop the file. You can also move and copy files through menu options.

To print a text file, drag it to the OS/2 Printer icon and drop it. Double-click on an executable to run it; double-click on a document file to open it within the program that manages it. Menu items let you set up additional associations, change file attributes, customize the file display, and more.

FILES:

WARPCA.EXE—A self-extracting file that will create the necessary files to install and run Warp Cabinet.

WARPCAB.TXT—The documentation file.

WARPCAB.ZIP—The source, program, and documentation files.

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PC Solutions

TIPS AND TECHNIQUES TO INCREASE YOUR PRODUCTIVITY

User-to-User

By Neil J. Rubenking

Delete Files by Date in Windows 95

The Solutions item of September 12, 1995, on deleting files older than a certain date suggested using the `XCOPY/D` command to copy files that are newer than the date to a temporary directory, then using the `FOR` command to delete the files not copied to the temporary directory (that is, the older files). The item also indicated that this technique is not very efficient when dealing with a large number of files. Here are a couple of alternatives for Microsoft Windows 95 users.

The new Find Files dialog provides a way to locate files in a date range, so you could search for files older than a given date, then select all the files and delete them. Here's how: Open the Find Files dialog via `START\Find Files` and select the Date Modified tab. Select the "between" button and specify a date range, then press Find Now. When the search is done, choose the Edit\Select All menu item to select all the files and then File\Delete to delete them.

For those who prefer the batch approach, the Windows 95 `XCOPY` command includes a `/L` option, which displays the files that would be copied but does not actually do the copy. Perhaps you could employ this list to avoid the inefficient copying.

MICHAEL GIROUX, via ZD Net

PC MAGAZINE: Windows 95's Find Files dialog introduces features that are far beyond the Search option of Windows 3.1's File Manager. Naturally, you can search a directory, a drive, or even all drives for files matching a template. Also, the template string will be found anywhere within a filename. For example, the string "MA" will match `COMMAND.COM`, and "Microsoft" will match the Microsoft Network. You can specify a range of dates and a maximum or minimum size. You can even search for files containing a particular text string. So if you're using Windows 95, the Find Files dialog will definitely solve the problem of deleting all files created on or before a certain date.

Also, the new features of Windows 95's `XCOPY` do indeed make possible a batch file that will delete matching files older than a

given date, without expending time or disk space unnecessarily copying the newer files. Possible, yes; simple, no. `DELB4.BAT` (Figure 1) relies on a number of advanced batch programming concepts discussed in previous User to User columns.

`DELB4.BAT` takes two parameters, a file specification in the current directory and a date, and deletes all files matching that specification that were created or last changed before the specified date. Its first few lines check the presence and validity of these parameters. If there aren't two parameters, if the first parameter doesn't match any files, or if the first parameter is not a wildcard file specification, `DELB4` explains the problem and quits.

The line that detects a wildcard file specification may come in handy in other batch files:

```
FOR %%v IN (%1) DO IF  
- '%%v'=='%1' GOTO NoWildcard
```

It simply compares each value returned by the `FOR` command to the input string. If the string contained wildcards, none of the individual matching filenames will be identical to the input string.

Next, `DELB4.BAT` uses the new features of `XCOPY` to build a list of files created on or later than the specified date. The new `/L` switch tells `XCOPY` just to list the files it would copy, without performing the copy. Adding the new `/I` switch instructs `XCOPY` to treat a nonexistent destination as a directory automatically when multiple files are being copied, so it doesn't stop and ask whether the destination represents a file or directory. As usual, the `/D:` switch followed by a valid date causes `XCOPY` to copy files created on or after that date. The word *nothing* on the command line stands for the never-used destination. The result of this command is a list of files created on or after the specified date, stored in the temporary file `NEWER$$$1. $$$`.

If the `DOS ERRORLEVEL` is nonzero after the `XCOPY` command, it's probably because the passed date wasn't valid, so `DELB4.BAT` reports an error and quits. Otherwise, the next step is to process the file list and set the read-only attribute for each file on the list. `DELB4.BAT` first strips off the line that reports the number of files. Then it uses the `FC` com-

HIGHLIGHTS



HARDWARE HP's printer control language may be keeping you from printing as many copies as you'd like. Here's a workaround. *page 230*



OPERATING ENVIRONMENTS OS/2 Warp FixPak 10 will fix bugs in any version of Warp, but installation can be tricky. Brian Proffitt provides some tips to make the process less painful. *page 234*



DATABASES Find out how to bypass the Windows printer driver and send data directly to your printer in Paradox for Windows. *page 248*

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mand to compare the file list with the NUL device, producing a mismatch on every line. The /LB200 switch lets FC process 200 mismatched lines before giving up, and the /N switch causes it to report the line number with each mismatch.

The output of the FC command is piped to the DATE command as input. Every line is invalid input for DATE, so DATE repeatedly outputs an error message and tries the next line. Finally, DATE's output is filtered through FIND to select only the lines containing the original filenames from the list. Each filename is transformed into a line like this:

```
Enter new date (mm-dd-yy): 1: delb4.bat
```

The collection of these lines is stored in a file named EN#ER.BAT.

The point of this exercise is that when DOS

executes such a line, it attempts to run a program or batch file called ENTER, passing it the filename (among other things). DELB4.BAT creates ENTER.BAT for just this purpose. Since ENTER.BAT is executed without the use of CALL, only the first line of EN#ER.BAT will get executed. Thus DELB4.BAT somehow needs to execute EN#ER.BAT repeatedly, making each line in turn be first.

ENTER.BAT strips the first line from EN#ER.BAT by using FIND to reject lines containing the number passed as its fourth parameter. It's not easy to create a secondary batch file that includes redirection symbols; to do so, DELB4.BAT uses a technique explained in a previous User to User column (December 5, 1995). It then sets the read-only attribute for the file passed as its fifth parameter.

DELB4.BAT repeatedly calls EN#ER.BAT in a loop. Each pass through the loop sets one file to read-only and deletes one line from

EN#ER.BAT. When all lines from EN#ER.BAT have been deleted, the loop ends. DELB4.BAT deletes ENTER.BAT and EN#ER.BAT and, if DELB4.BAT is present in the current directory, makes itself read-only. Now all files matching the filespec that are newer than the specified date have been set to read-only and thus are protected from deletion.

Before actually performing the deletion, DELB4.BAT lists the files that will be deleted. It uses the DIR command's switches to display files that don't have the read-only attribute, sorted in reverse date order, and asks for confirmation. If the user presses Y, it deletes all files matching the passed file specification. Of course, read-only files aren't touched. A little cleanup and the process is finished.

This is a complex batch file and one that works only in a Windows 95 DOS box. The added features in the XCOPY command are evidence that DOS is not dead yet.

```
ECHO OFF
REM DELB4.BAT - delete files before a given date
REM (the name DELB4.BAT is hard-coded; don't change)

IF '%2'==' ' GOTO Syntax
IF NOT EXIST %1 GOTO NotExist
FOR %%v IN (%1) DO IF '%v'=='%1' GOTO NoWildcard
CLS
ECHO DELB4.BAT: Deleting files matching %1 dated before %2
ECHO.
xcopy %1 /I /L /d:%2 nothing > NEWER$$1.$$$
IF ERRORLEVEL 1 GOTO Error

find /v "File(s)" <NEWER$$1.$$$ >NEWER$$2.$$$
FC NEWER$$2.$$$ NUL /LB200 /N | DATE | FIND ": " >
EN#ER.BAT
del NEWER$$2.$$$

:: EN#ER.BAT now contains lines of the form
:: "Enter new date (mm-dd-yy): 1: delb4.bat"
:: Each call to EN#ER.BAT invokes ENTER.BAT once.
:: protecting first file and stripping first line
:: from EN#ER.BAT. Now create ENTER.BAT:

ECHO REN EN#ER.BAT EN@ER.BAT>ENTER.BAT
ECHO %%% FIND /V " %4" <EN@ER.BAT >EN#ER.BAT
%%%>ENTER.BAT
ECHO DEL EN@ER.BAT>>ENTER.BAT
ECHO SET DidEnter=Yes>>ENTER.BAT
ECHO IF NOT EXIST %5 SET DidEnter=Err>>ENTER.BAT
ECHO ATTRIB +R %5>>ENTER.BAT

:Loop
SET DidEnter=
CALL EN#ER.BAT
IF '%DidEnter%'=='Yes' GOTO Loop
IF '%DidEnter%'=='Err' GOTO NotCur

SET DidEnter=
DEL EN?ER.BAT
IF EXIST DELB4.BAT ATTRIB +R DELB4.BAT
```

```
ECHO Files to be deleted:
DIR %1 /A-D-R /O-D | Find "-" | Find /v "e"
CHOICE Ok to delete these files
IF ERRORLEVEL 2 GOTO Nope
ECHO Y | DEL %1 >> NUL
:Nope
ATTRIB -R %1
IF EXIST DELB4.BAT ATTRIB -R DELB4.BAT
DEL NEWER$$1.$$$

GOTO End

: NoWildcard =====
ECHO %1 does not include any * or ? wildcards
: Syntax =====
ECHO Syntax: DELB4 filespec mm/dd/yy
ECHO where filespec is a wildcard file specification
ECHO in the current directory
GOTO End

: NotExist =====
ECHO Sorry, no files match %1.
GOTO End

: NotCur =====
SET DidEnter=
DEL EN?ER.BAT
DEL NEWER$$1.$$$
ECHO The first parameter to DELB4.BAT should not contain
ECHO path information. DELB4.BAT is meant to work in the
ECHO current directory. The error that happened suggests
ECHO that the first parameter referred to files in some
ECHO other directory.
GOTO End

: Error =====
ECHO Error with XCOPY; probably %2 is a bad date

: End =====
```

FIGURE 1: This DOS 7-specific batch file deletes files older than a specified date that match a file specification in the current directory.

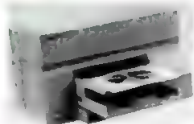


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Sportster VI DSVN Int	\$269.82
Sportster VI 14.4 Int	107.90
Sportster V.34 Int	175.82
Sportster V.34 Ext	163.65
Courier V.34 Int	366.70
Courier V.34 Ext	415.00

NEC

\$4,579.²⁵

4000TC P.90 810MB 8MB CD-ROM Active Color

2000C DX475 540MB 8MB Active Color	\$2,089.00
4000D P.75 540MB 8MB CD-ROM Active Color	3,682.00
2000D DX475 350MB 4MB Dual Scan Color	1,945.00
4000TC P.90 810MB 8MB CD-ROM Active Color	4,579.25
4000HC P.90 810MB 8MB Hi-Color	5,233.29

COMPUTERS

COMPAQ

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ProLinea 580 P.90 8/630MB	1,849.60
ProLinea 575 P.75 16/1GB	2,078.92
ProLinea 590 P.90 16/1GB	2,329.40
ProLinea 5120 P.1120 16/1GB	2,638.76
ProLinea 5133 P.1133 16/1GB	2,937.10
Deskpro 575 P.75 8/630GB	1,799.95
Deskpro 575 P.75 8/1GB	2,344.40
Deskpro 590 P.90 8/630MB	2,113.05
Deskpro 590 P.90 16/1GB	2,596.86
Deskpro 5120 P.1120 16/1GB	2,910.30
Deskpro 5133 P.1133 16/1GB	3,122.77

AST

Bravo MS P.75 8/850MB	\$1,644.05
Bravo MS P.75 16/1.2GB	2,069.00
Bravo MS P.100 8/850MB	1,947.60
Bravo MS P.100 16/1.2GB	2,409.62
Bravo MS P.120 16/1.2GB	2,596.42
Bravo MS P.133 16/1.2GB	2,689.00
Bravo MS-T P.100 8/850MB	2,011.90
Bravo MS-T P.100 16/1.2GB	2,489.55
Bravo MS-T P.133 16/1.6GB	3,244.70

NOTEBOOKS

NEC

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4000D P.75 540MB 8MB CD-ROM Active Color	3,682.00
2000D DX475 350MB 4MB Dual Scan Color	1,945.00
4000TC P.90 810MB 8MB CD-ROM Active Color	4,579.25
4000HC P.90 810MB 8MB Hi-Color	5,233.29

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410COT P.90 772MB 8MB 4X CD Active Color	4,498.82
400COT P.75 772MB 8MB 4X CD Active Color	3,650.89
400CS P.75 772MB 8MB 4X CD Dual Scan Color	2,999.62
T2110CS DX475 330MB 4MB Dual Scan Color	1,645.13
700COT P.100 1.2GB 8MB Active Color	2,799.85
700CS P.100 1.2GB 8MB Dual Scan Color	4,539.00
610COT P.90 720MB 8MB Active Color	3,880.32

TEXAS INSTRUMENTS

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450T DX475 340MB 4MB Active Color	2,077.72
550 P.75 524MB 8MB Dual Scan Color	2,380.70
550COT P.75 524MB 8MB CD Dual Scan Color	2,864.90
550COT P.75 524MB 8MB CD Active Color	3,441.00
TM6000 P.75 524MB 8MB Dual Scan Color	2,863.05
TM5000 P.75 810MB 8MB Active Color	3,821.53
TM5000 P.90 1.2GB 8MB Active Color	4,382.79

AST

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Ascentia 950N 800MB 8MB Dual Scan	2,869.91
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FX1170	362.71
LQ870	430.57
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Stylus Color Pro Ink	768.15
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Optra Lx+ 1200dpi 16ppm	1,842.93
Optra R+ 800 dpi 16 ppm	1,274.20
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KX-P2130 24ppm	203.00
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KX-P6500 Laser 6ppm	439.70

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MicroLaser Pro E 12ppm	1,363.10

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Ask Our Advisors

HARDWARE

Copy Limits



I can't seem to print more than 99 copies of a Microsoft Word 7.0 document on my Hewlett-Packard LaserJet 4. I thought my LaserJet might be suffering from a lack of RAM until I tried printing 100 copies of a one-character document and still only got 99. HP told me to call Microsoft since Microsoft wrote the drivers, Microsoft told me to call Gateway since my software was pre-loaded, and Gateway told me to wait for a new driver from Microsoft. Do you know any way to solve this problem?

ALAN ZOECKLER, Arlington, Virginia

PC MAGAZINE: It certainly is frustrating to get shunted from one support technician to another, only to be told to wait for a new driver. In fact, waiting is not likely to do you a bit of good, since the problem is not in Word 7.0, or the Windows driver, or, for that matter, in Windows itself. You're running up against a limitation of PCL, HP's printer control language. The command that instructs the print-

er to make multiple copies of each page takes the form

<ESC>&1nnX

where nn is a number from 1 to, unfortunately, 99. Although the Copies field of the Windows Print dialog happily accepts larger numbers, the driver still puts 99 into the command string, because that's the limit of the parameter. (You can verify this yourself by printing to a file instead of to your LaserJet, then looking at the command codes.)

You encounter the limitation when the Collate Copies check box in the Windows Print dialog is cleared (meaning that all copies of page 1 will print first, then all copies of page 2, and so on), but there's actually a significant advantage to this approach—speed. Since the driver can use the multiple-copy command, it needs to send each page to the printer only once, and that means your computer will spend minimal time transferring the data to the printer; the computer will return to full speed almost immediately, and the printer will be able to churn out the pages at full engine speed. The downside, in addition to the copy

limit, is that you may have to do a lot of collating by hand.

If, on the other hand, you check the Collate Copies box in the Print dialog, the driver can't use the PCL multiple-copy command; instead it must send each page in turn. Suppose, for example, you want to print several copies of a two-page letter. The driver will have to send page 1 followed by page 2, then repeat the process until all copies have printed—the data gets sent to the printer for each copy of each page. Meanwhile, other tasks may bog down, since creating a print file—especially for a complex page—can take a lot of processing, and the print manager may need to consume a good chunk of disk space for its spooling file. The printer, too, may run below its rated speed if, after printing one page, it ends up waiting for the next. The good news, though, is that if you put a number greater than 99 in the Copies box, you'll get that many copies. You can confirm this also by printing a document to a file instead of to your printer.

A trick that compromises between these two approaches can serve as a workaround. Let's say you want 300 copies of a two-page letter and you're willing to do the collating by hand. Simply insert three more copies of page 1 before the second page, then add three copies of page 2. The result is an eight-page

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GROUP	229
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Magitronic	231
MIDWEST COMPUTER	
WORKS	242
Midwest Micro	262
PCs Compleat	254
USA Flex	246
SOFTWARE/PERIPHERALS/COMPONENTS	
ARLINGTON COMPUTER	
PRODUCTS	260
COMPUTER DISCOUNT	
WAREHOUSE	250
First Source International	258
H. Co Memory Upgrades	271
HARTFORD COMPUTER	
GROUP	229
INSIGHT DIRECT, INC.	235
LA Trade	245
MEGAHAUS	249
Micro Solutions	270
MIDWEST COMPUTER	
WORKS	242
PC Connection	261
PC Mail	268
PC Zone	264
SPSS, Inc.	263
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IBM

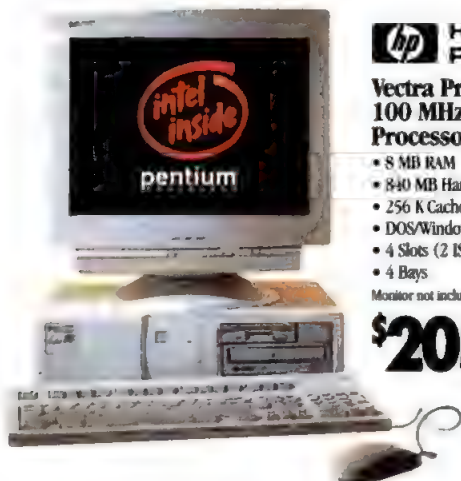
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P133 0115149



**hp HEWLETT
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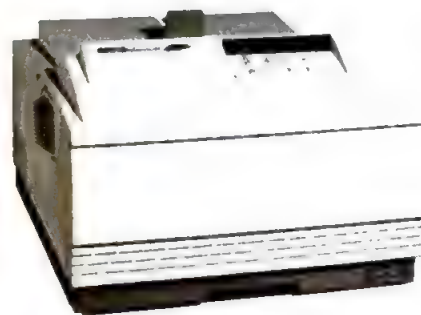
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HP Laserjet 5P #666631	849 ⁹⁷

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Keep in mind that for print runs of more than a hundred or so copies, the cost of toner may be greater than what you'll pay for photocopying or offset printing at a local quick-print place.—*Alfred Poor*

Lost Without Interlnk

I have both a desktop computer and a laptop, and I want to use the CD-ROM drive in the desktop when installing software to the laptop. I've upgraded both systems to Windows 95, and I want to know how to connect them as I could with the DOS 6 Interlnk utility. Can you tell me how to do this?

TERENCE STEPHENSON,
Irvine, California

PC MAGAZINE: You could probably get Interlnk to run on two Windows 95 systems, but it's not necessary thanks to the Direct Cable Connection (DCC) feature that's included in Windows 95.

DCC is not part of the typical Windows 95 installation, but you can easily add it. Choose the Add/Remove Programs icon in Control Panel, then click the Windows Setup tab. Click on Communications in the Components list and then on the Details button. Choose Direct Cable Connection and choose OK. Be sure to install DCC on both systems.

Next you need to link the two computers via either the serial ports or the parallel ports; the cable you used with Interlnk should work. A serial connection requires a null-modem cable, while a parallel connection requires ports capable of bidirectional communication and a parallel cable as well. Parallel port connections are recommended, since parallel cables send data over multiple wires simultaneously, resulting in the fastest data transfer. Once the cable is in place, a wizard that runs the first time you open the Direct Cable Connection can help you establish the connection between your computers. One computer serves as the host, the other as the guest.

You can use the Direct Cable Connection only to connect two computers running Windows 95. If that's not what you have, you can buy a commercial program such as LapLink

for Windows or WinLynx that will run under both Windows 3.x and Windows 95. These programs typically include the necessary cable.—*Alfred Poor*

Memory Misstep

Every day when I boot my computer for the first time, I get a message from EMM386 about an error detected at memory address 00B8:2C24. I then press reset, the computer boots, and I have no further problem for the rest of the day. The next day, though, the problem reappears when I boot up. Is there some "exclude" parameter I should be using with EMM386?

KENNY CARTER, Corsicana, Texas

PC MAGAZINE: EMM386 does have an exclude parameter, but I doubt it will help because your error occurs at an address that's at the very beginning of system memory. In fact, it's unlikely that the problem has anything to do with EMM386; the more likely culprit is a bad memory chip or something related.

One of my favorite rules of thumb is that cold failures are mechanical, hot failures are silicon. The fact that your problem appears

Direct Cable Connection is not part of the typical Windows 95 installation, but you can easily add it.

when the computer is cold, then goes away as soon as the computer has warmed up a bit, leads me to suspect a mechanical problem.

Start by removing and reseating the SIMMs (or whatever form your system memory is in) to make sure that each module has a good connection in its socket. (The trick to removing a SIMM is to unlock the little clips at each end first. You can get a little tool designed just for this purpose, but a thin, flat-bladed screwdriver should work just as well. Release one end and then apply a little pressure to hold the SIMM away from that tab while you unlock the other end. The SIMM should then slide out of the slot fairly easily.)

If reseating the SIMMs doesn't solve the problem, try swapping two SIMMs and then see if the address changes. If it does, this means one of the SIMMs may be the cause; either a bad memory chip or a bad solder joint could give you this type of result. If the address is the same, continue testing the SIMMs until the address does change and you've isolated the malfunctioning module. You can replace the failed SIMM, just be sure the new

one matches the specified requirements for your motherboard.

If the problem is a bad solder joint, however, try using different memory configurations to avoid that slot. Otherwise the only solution may be to replace the motherboard.—*Alfred Poor*

OPERATING ENVIRONMENTS

Installing OS/2 Warp FixPak 10



When I was installing Warp FixPak 10, it skipped from disk 1 to disk 5. Is this normal?

Installation of FixPak 10 freezes during the first disk...

I get an error message during installation of FixPak 10 that the archive is full...

FixPak 10 installation tells me I'm at the wrong service level. But I just installed Warp. How could I be at the wrong level?

These are just a few of the questions I've received about OS/2 Warp FixPak 10. FixPak 10 is the first publicly available set of fixes for all versions of Warp. This set of six floppy disks and two README files, available from the OS2SUPPORT forum on CompuServe and IBM's BBS, contains a number of valuable updates, but installation is proving far from painless for many users. Typos and omissions in the 24-page (!) README files make it even more confusing. But there are a few things you can do before installing this FixPak to make sure the process goes smoothly. And it's worth noting at the start that unless you're having specific problems with Warp, there's no real reason to bother installing FixPak.

The files you download are actually disk images you use to create the floppy disks that are then used to install FixPak. As discussed in the README files, you run LOADDSKF against the image files to create the complete set of disks. Note, though, that FixPak's six disks are not sufficient by themselves. Two more disks, called the *kicker* disks, are needed to boot the OS/2 Corrective Service Facility and load the FixPak. The kicker disks are packaged separately because they can be used for any FixPak; you can download them once and reuse them for future FixPaks.

Before you even install FixPak, you need to check your system for superfluous syslevel files—the log files that tell OS/2 the current level of each of its components. Unfortunately, other software—particularly video drivers—may modify these files or copy them to various places during the driver's installation process. Open the OS/2 System folder on your desktop and the Productivity folder within it. From the Productivity folder, open Seek and Scan Files to see a window similar to that in Figure 1. As the figure indicates,

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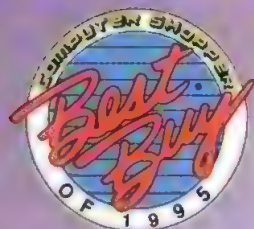
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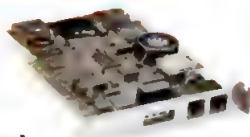
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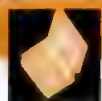
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TravelMate 5100	Pentium 90	10.4" Active	8MB/1.2GB	TEXTP90CT	4,069
TravelMate 5200	Pentium 120	10.4" Active	8MB/1.2GB	TEXT5200	4,999
Extensa 450T	486DX4/75	9.4" Active	4MB/320MB	TEXT450CT	1,899
Extensa 450	486DX4/75	10.4" Dual Scan	4MB/320MB	TEXT450CS	1,659
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Extensa 550CD	Pentium 75	10.4" Dual Scan	8MB/524MB	TEXT550CD*	2,865
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Satellite Pro 410	Pentium 90	11.3" Active	8MB/772MB	TA410CDT7*	4,569
Satellite Pro 410	Pentium 90	11.3" Dual Scan	8MB/772MB	TA410CS7	3,419
Tecra 700	Pentium 120	11.3" Dual Scan	8MB/1.13GB	TA700CS	4,589
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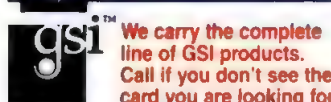


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4294MB	9ms	3.5" HH	Fast-SCSI-2 A/V	512	5,411	ST15230N	959	1,059
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Quantum SCSI Drives								
850MB	14ms	3.5" 1"H	Fast-SCSI-2	128	4,500	QUTR850S	\$229	\$329
1080MB	12ms	3.5" 1"H	Fast-SCSI-2	128	5,400	QUFB1080S	299	399
2216MB	8.5ms	3.5" 1"H	Fast-SCSI-2	512	5,400	QVVP3221S	699	799
2150MB	8ms	3.5" 1"H	Fast-SCSI-2	1,024	7,200	QUXP3125S	799	899
4300MB	8ms	3.5" HH	Fast-SCSI-2	1,024	7,200	QUXP4300S	1,099	1,199
Conner SCSI Drives								
1080MB	11ms	3.5" 1"H	Fast-SCSI-2	256	5,400	CFP1080S	\$299	\$399
2147MB	8.5ms	3.5" 1"H	Fast-SCSI-2	512	5,400	CFP2105S	699	799
2147MB	8.5ms	3.5" 1"H	Fast-SCSI-2	512	7,200	CFP2107S	799	899
4294MB	9ms	3.5" HH	Fast-SCSI-2	512	7,200	CFP4207S	1,079	1,179
IBM SCSI 68 Pin Wide Drives								
2100MB	7.5ms	3.5" 1"H	Fast Wide SCSI-2 A/V	512	7,200	IB94G3054	\$1,145	\$1,245
4500MB	8ms	3.5" HH	Fast Wide SCSI-2 A/V	512	7,200	IB94G3057	1,699	1,849
5310MB	8ms	3.5" HH	Fast Wide SCSI-2 A/V	512	5,400	IB94G3059	1,499	1,649

**Capacities based upon manufacturer's quoted capacity where 1MB = 1,048,756 bytes.

Capacity**	Access	Form/Height	Interface	Cache	RPM	Model	Bare Kit	16 Bit Kit
Western Digital IDE Drives								
635MB	10ms	3.5" 1"H	Enhanced IDE	64	4,500	WD2635A	\$179	\$229
850MB	10ms	3.5" 1"H	Enhanced IDE	64	4,500	WD2850A	199	249
1080MB	10ms	3.5" 1"H	Enhanced IDE	128	5,200	WD21000A	229	279
1280MB	10ms	3.5" 1"H	Enhanced IDE	64	4,500	WD31200A	269	319
1280MB	10ms	3.5" 1"H	Enhanced IDE	128	5,200	WD21200A	NEW! Call for Pricing	
1620MB	10ms	3.5" 1"H	Enhanced IDE	128	5,200	WD31600A	339	389

**Capacities based upon manufacturer's quoted capacity where 1MB = 1,048,756 bytes.

Capacity**	Access	Form/Height	Interface	Cache	RPM	Model	Bare Kit	16 Bit Kit
Fujitsu IDE Drives								
545MB	14ms	3.5" 1"H	Fast-ATA-2	64	4,500	FJ612A	\$159	\$179
1090MB	12ms	3.5" 1"H	Fast-ATA-2	64	4,500	FJ614A	215	265
Quantum IDE Drives								
850MB	14ms	3.5" 1"H	Fast-ATA-2	128	4,500	QUTR850A	\$209	\$259
1080MB	12ms	3.5" 1"H	Fast-ATA-2	128	5,400	QUFB1080A	235	285
1280MB	12ms	3.5" 1"H	Fast-ATA-2	128	5,400	QUFB1280A	259	309
Maxtor IDE Drives								
540MB	12ms	3.5" 1"H	Enhanced IDE	32	3,600	MX7540AV	\$179	\$229
850MB	12ms	3.5" 1"H	Enhanced IDE	64	3,600	MX7850AV	205	255
1260MB	12ms	3.5" 1"H	Enhanced IDE	256	4,500	MX71260A	260	310
1620MB	11ms	3.5" 1"H	Enhanced IDE	256	4,500	MX71626A	349	399
Conner IDE Drives								
635MB	14ms	3.5" 1"H	Enhanced IDE	32	3,600	CFS635A	\$185	\$235
850MB	14ms	3.5" 1"H	Enhanced IDE	32	3,600	CFS850A	199	249
1275MB	14ms	3.5" 1"H	Enhanced IDE	32	3,600	CFS1275A	259	309
IBM IDE Drives								
540MB	12ms	3.5" 1"H	Fast-ATA-2	256	4,500	IB06H7141	\$185	\$205
1080MB	10.5ms	3.5" 1"H	Fast-ATA-2	512	5,400	IB94G3186	269	319

**Capacities based upon manufacturer's quoted capacity where 1MB = 1,048,756 bytes.

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2.1GB IDE Drive
• 2113MB capacity
• 10.5ms access
• IDE Fast ATA-2
• 256KB cache
• 5,400rpm

ST31240A **\$399**

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Sportster 14.4 Internal MBUSPT079	95
Sportster 28.8/14.4 V34 External MBUSRSP34E	195
Sportster 28.8/14.4 V34 Internal MBUSRSP34I	185
Sportster 28.8/14.4 S/R Voice View Int. MBUSRV028	229
Sportster 14.4/14.4 S/R Voice View VI Ext. MBUSRV04E	225
Sportster 14.4/14.4 S/R Voice View VI Int. MBUSRV14I	109
Sportster 28.8/14.4 S/R Voice View VI Int. MBUSRV28I	235
Sportster 14.4/14.4 S/R Voice View DSDV Int. MBUSRV028	275



Bit Surfer Pro ISDN External MBUSPT079	\$369
Bit Surfer TA210 ISDN External MBUSPT079	259
Bit Surfer ISDN ISA Internal MBUSPT079	289

Simple Internet 28.8 External MBUSP3ME	\$169
Simple Internet 28.8 External MAC MBUSP3ME	209
Simple Internet PNP 28.8 Internal MBUSP3ME	155

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15" 28dp 1280x1024 Nt CMX1595	379
15" 25dp 1280x1024 Nt CMX1517	349
17" 28dp 1280x1024 Nt CMX1795	699
17" 25dp 1280x1024 Nt CMX1717	789
21" 28dp 1600x1200 Nt CMX2117	1,689
15" MXE15F 28dp 1280x1024 Nt CMX1517	439
17" MXP17F 28dp 1600x1200 Nt CMX1717	799



14" 28dp 1024x768 Nt CMX1495	\$249
15" 28dp 1280x1024 Nt CMX1595	419
17" 28dp 1280x1024 Nt CMX1795	659
17" 28dp 1600x1200 Nt CMX1795	699



20" 31dp 1280x1024 Nt CMX2015	\$1,089
15" 28dp 1280x1024 Nt CMX1595	349
17" Megnacron 28dp 17B CMMAA018	679
15" 2015 28dp 1024x768 Nt EPA CMMAA015	325
14" 2099 28dp 1024x768 Nt EPA CMMAA099	249
17" 4018 28dp 1280x1024 Nt MPPII EPA CMMAA018	659
14" 75M74 28dp 640x480 White Mono CMMA75M74	109



15" 1562CLR 28dp 1024x768 Nt CMCA1562CL	\$349
14" 1451C 28dp 1024x768 Nt EPA CMCA1451C	279
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17" 1785GME 28dp 1600x1200 Nt CMCA1785GME	789

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Back UPS Pro 420 PNP 420 V/A Bundle UPAPCBK42P	235
Back UPS Pro 650 PNP 650 V/A Bundle UPAPCBK65P	289

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Edge 3D 2200XL PCI 2MB DRAM VIDEOP11R	319
Edge 3D 3240XL PCI 2MB VRAM 4MB max VIDEOP20R	415
Edge 3D 3400XL PCI 4MB VRAM VIDEOP22R	559

SYSTEMS



AMD 486DX4100E 4/540MB Monitor IV10E045	\$999
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Pentium 75MHz 8/540MB IBAS7503F	\$1,829
Pentium 100MHz 16/850MB IBAS8507H	2,429



Pentium 100MHz 8/850MB 501789-001	\$1,669
Pentium 100MHz 16/850MB 501772-001	1,819
Edge 3D 133MHz 16/12GB 501815-001	2,739

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EtherExpress Pro/100 PCI NWHT8485	219
EtherExpress Pro/100 TX PCI NWHT8485	145
NetPort II NWHT1211	369
Express Stackable Hub 100 Base TX NWHT1907X	1,999

Etherlink III ISA TP NWCS308TP	\$95
Etherlink III ISA PC Card Combo NWCS308COM	199
Etherlink III ISA PC Card TP NWCS308CTP	155
Etherlink III ISA BNC NWCS308BT	109
Etherlink III ISA Combo NWCS308C	121
Etherlink III PCI TP NWCS308TP	121
Etherlink III PCI Combo NWCS308C	159
Fast Ethernet 10/100 PCI TP NWCS308TX	225
Linkbuilder 100Mbps FMS 12 port TP NWCS308TX	1,949



EtherEZ Network TP Card NWSMC8418T	\$89
EtherEZ Network Combo Card NWSMC8418T	99
EtherEZ Network Coax Card NWSMC8418B	89
EtherPower 10/100 PCI NWSMC8332	199
EtherPower PCI Combo NWSMC8332T	145
Tigerhub 100 Fast Ethernet NWSMC8318T	2,349
TigerSwitch XE 24 Port Switch NWSMC8318T	3,999



PC Card Ethernet Adapter NWXC210EC	\$189
PC Card Ethernet Adapter NWXC281T	149
PC Card Ethernet/Modem Adapter NWXC2810B	439
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ZIP External 28mb 1MB/sec transfer TB03200Z	199.95
JAZ 1GB Removable SCSI TB04200J	599



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10H Library DAT 6MM 70-140GB capacity TBEX10H	\$4,999
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SCSI2-Fast 16bit Kit CD-ROM Kit AD1560KIT	55
SCSI2-Fast 16bit Kit no floppy AD152AKIT	149
SCSI2-Fast 16bit Kit no floppy AD153PKIT	179
SCSI2-Fast PNP 16bit Kit Busmaster AD1540	199
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SCSI2-Fast PNP 16bit Busmaster AD1540KIT	289
SCSI2-Fast VLB 32bit Kit 2 floppy Busmaster AD2040KIT	259
SCSI2-Fast PCI 32bit Kit 2 floppy Busmaster AD2040KIT	289
SCSI2-Wide PCI 32bit Kit 2 floppy Busmaster AD2040KIT	319



SCSI2-Fast PCI 32bit Kit WD7193	\$229
SCSI2-Wide PCI 32bit Kit WD7197	299



VLB 32bit Controller 8T45C	\$219
SCSI2-Fast PCI 32bit Kit 1mmc	289
Ultra SCSI PCI 32bit Kit no floppy 8T45C	169

PCI 32bit Controller Corsi QUPC10	\$209
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SCSI2-Fast PCI 32bit Basic Controller QUPC10BASIC	119
SCSI2-Fast EISA H/F QUPC10H/F	199
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SCSI2-Fast Wide 32bit no floppy QUPC10	289



8bit 4 floppy 2X QIC 80 GSI00C11	\$55
IDE 16bit no floppy BIOS Controller GSI00C11	39
IDE 16bit BIOS Controller H/F Tape GSI00C12	49
IDE 16bit BIOS Controller H/F 2S/1P GSI00C13	109
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CD-ROM Controller 16bit GSI00C15	15
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Entertainment max-EDUT1	\$249
Six Speed ODDTQUADE	349

PRINTERS



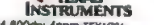
Microline 320 Printer Spin 300cps OK320	\$329
OLB00E LED Printer 600dpi 1MB 6ppm OK320E	399



DeskJet 850C Color Inkjet 600dpi 8ppm 1MB HP850C	\$499
LaserJet SL-45 600dpi 4ppm 1MB HP45	509
LaserJet SP 600dpi 2MB 6ppm HP45SP	679



BJC 610 Color Inkjet 720dpi 300cps C480C10	\$549
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Microlessor Win/4 800dpi 4ppm TEX1031	\$448
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Stylus Pro Color Inkjet 720dpi 30ppm EP835PRO	\$799
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4520MP 800dpi 8MB 20ppm Wide XE4520MP	\$3,549
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MISC



CL32 IDE Sound Blaster Waveblaster M4CL322VM	\$160
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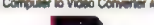
DC1Plus Digital Video Capture Editing System MBACV1PLS	\$389
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Snappy Parallel Port Ext Video Capture Board MBUSVAPPY	\$195
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Avrkey 3 for PC Computer to Video Converter AVRKEY3	\$299
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Surround Speaker w/Subwoofer Dolby AC900	\$329
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SRS-D4K 30 Watt 3 piece Shielded Speakers SRS-D4K	\$209
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486DX33 486DX266 CPUs	\$259
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SCSI 6X 900KB/S Internal ODDT6PLEX	399
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CD-ROM Tower SCSI 600KB/S 4X 7dr/7day ODDT4CS	3,519



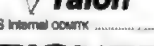
IDE 4 SX 685KB/S Internal ODDT4HTE	\$149
SCSI 4X 600KB/S Internal ODDT4HSE	179



IDE 6X 900KB/S Internal ODDT6TEAC	\$249
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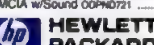
7 Disc Changer SCSI 4X 600KB/S External ODDT6N30	\$359
4 Disc Changer IDE 4X 600KB/S Internal ODDT6N31	279



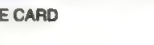
IDE 4X 600KB/S Internal ODDT4TAL	\$119
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6 Disc Changer IDE 4X 675KB/S External ODDT6P6X	\$399
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PCMCIA Dieman 2X 300KB/S External ODDT6D20	\$299
2X Portable PCMCIA w/Sound ODDT6D21	549



SureStore CD Writer 40201 SCSI ODDT6P42	\$999
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SOFTWARE

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MS Win NT 3.51 Server CD Value Pack w/10 Client Lic. 21570E	929
MS Win NT 3.51 Workstation CD full pkg 21571E	289
Chrysema Inoculator for Win NT 1 Servers workstations 21585	549
Chrysema Antivirus 2.0 for Win NT 3.51 21573E	65
CD Mail Desktop Win 2.2.3.5 214560	139
MS Project Win 95 upgrade 3.5 21702E	799
MS Windows 95 upgrade CD 21702E	80.95
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MS Plus! Win 95 CD 21709E	43.95
MS Publisher Win 95 3.5 21712E	89
MS Schedule 32bit Win 95 CD 21712E	89
MS Works 95 CD full pkg w/Bookshelf CD 21708E	89
MS Access Win 95 upg 3.5 cmp/ver upg 21709E	89
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WP Presentations 3.0 Win cmp upg 3.5 21424E	49
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WP Info Central 1.1 Win 3.5 481853	65
WP Envoy 1.0 Win 3.5 21424E	119
Lotus SmartSuite 96 Win 95 upg CD full pkg 21715E	199
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Soft One Case Analyst Win 95 CD 21704E	69.95
ACT! 2.0 Win 3.5 1 user full pkg SWB0C46	169
ACT! Mobile Link 2.0 Win 3.5 Symantec 21585E	239
WP Perfect Office Pro 3.0 Win 3.5 21409E	539
Reschreiner First Accounting Win 95 3.5 21541E	108
Claris Works 3.0 Win 3.5 SWB0C46	159
QuickBooks Pro 3.1 Win 3.5 21643E	179
Quicken 5 Deluxe Win 95/Win 3.1/3.11 CD 21807	59
Corel DRAW 6 Win 95 upg from 5 to 6 CD 21788E	229
Corel DRAW 6 Win 95 upg from 3 to 4 CD 21788E	369
Corel DRAW 6 Win 95 package CD 21789E	499
D-Time Win 95 CD 21807E	59
Ram-Disc Pro for Windows 95 21548E	45

search all fixed disks for files named syslevel.*. You should find several, but only one with each extension; that is, only one syslevel.os2, one syslevel.mpm, and so on. Keep the versions that appear in the \os2\install and \mmos2\install directories of the Warp boot partition, but make sure to delete any extra copies of the files.

Next, make sure that Warp reports itself to be at the right level for this FixPak. Go to a command prompt and run the command SYSLEVEL. You're looking for a panel like the one in Figure 2, showing the level of the OS/2 Base Operating System. Make sure it shows a current CSD level of XR_3000, 3001, 3002, 3003, or 3004. If you see a number lower than that, FixPak will think you're not running Warp and refuse to install. Assuming you really are running Warp (run the VER command from a command prompt and make sure it reports OS/2 Version 3.00), chances are that the installation of some other software—certain video drivers are known for this—has changed your system level incorrectly. You'll need to copy the syslevel.os2 file from your original installation disks to your \os2\install directory before proceeding.

If you previously installed another FixPak, some files that should be deleted may still be hanging around. Check your \os2\install and \mmos2\install directories for the files log0000.os2, logstart.os2, and logarch.os2 (or files with the same name and .mpm exten-

forth), to another partition to save space on your boot drive, you'll need to tell FixPak where those components are so they can be updated properly. In your \os2\install directory, create a text file named userdirs that includes a line for each directory into which you've moved OS/2 files. If, for example, you moved all the applications to d:\apps, include the line D:\APPS* in the file.

During installation, FixPak will archive some of your existing files so you can back out of the process later if you want. This requires a couple of empty directories, so it's a good idea to create two new directories before installing FixPak, one for the OS/2 archives and another for the MMPM/2 archives. If you have more than one partition on your hard disk, consider putting these archives in a partition other than the Warp boot partition to save space. (If you do this, you need to use the manual rather than the automatic installation technique, as described below.) And don't forget, you'll need at least 10MB of free space on the Warp boot partition for the installation.

Now make sure there aren't any errors in your disk structure by booting from your OS/2 installation disks and running CHKDSK /F against the OS/2 boot partition and any others into which you've copied parts of OS/2. If CHKDSK reports errors, keep running it with the /F parameter until you get a clean report.

NOW CAN I INSTALL IT?

You are finally ready to install FixPak, but again you have a choice to make: whether to install by booting your system from the kicker disks or by running A:\SERVICE from a command prompt. It's far easier simply to boot your computer from the kicker disks and let the Corrective Service Facility install FixPak automatically. If you do this, though, note that FixPak will be installed on all parti-

tion return your computer to the pre-FixPak level. If that directory already exists from a prior FixPak installation or you need to put the archives in another partition with more space, you'll have to install FixPak manually.

For manual installation, insert the first

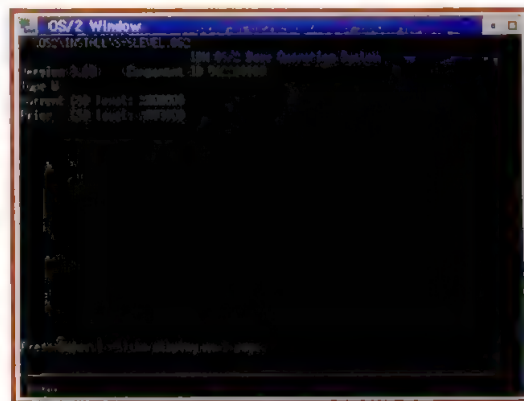


FIGURE 2: Make sure Warp is at the correct level.

kicker disk and type A:\SERVICE at a command prompt. You'll be able to specify the partitions you want to update and the directories you want to create to hold the archived files. Note that you must use a different directory for each component being updated, so base OS/2 and Multimedia Presentation Manager/2 (MMPM/2) need separate directories. (As indicated above, you should create those directories before starting installation to avoid an intermittent bug in the Corrective Service routine that creates the directories.) The manual technique also allows you to be more selective with service installation—for example, you can update the base operating system but leave MMPM/2 unchanged.

Whichever technique you use, if you originally installed Warp from a CD-ROM, many of the OS/2 files may have retained the read-only attribute from the CD. You may be asked several times whether read-only files should be overwritten. Be sure to always answer yes. And be patient during the archiving process: It may appear that your system has hung, but installation should resume within a few minutes.

Finally, after the FixPak installation, some users with IDE hard disks are suddenly unable to boot up. You may get an error message that Warp can't read your disk drive, or the boot process may entirely hang. Boot from the installation disks and go to a command prompt. Switch to the \os2\boot directory on the hard disk and delete the file ibm1s506.add. Now copy the original version of this file from the installation disk into that directory and your system should then boot normally.

This may seem like a cumbersome process, but it's really not too bad. And if you've encountered problems with Warp, installing FixPak 10 should prove worth the effort.

—Brian Proffitt

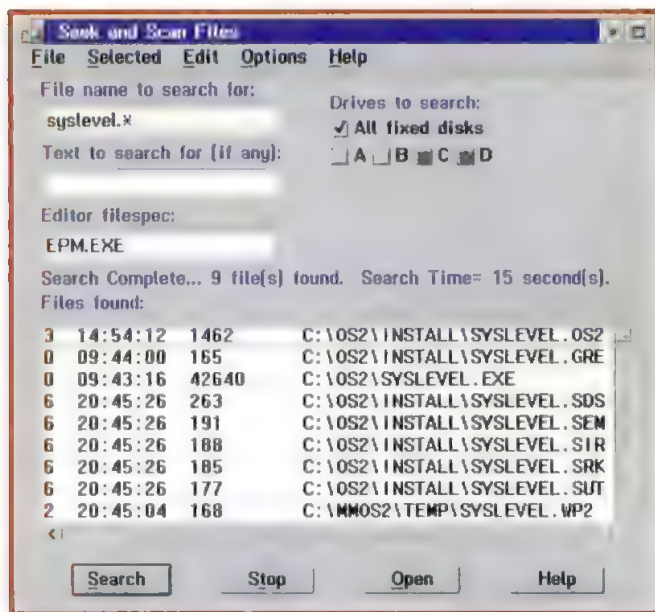


FIGURE 1: Find and eliminate any duplicate syslevel files.

tion). Also look for c:\csf_sel.000. You must rename or delete these files before installing FixPak 10.

Next, think about changes you've made to your system since installing Warp. If you've moved parts of OS/2, such as the \apps directory (Enhanced Editor, Seek and Scan, and so

on), to another partition to save space on your boot drive, you'll need to tell FixPak where those components are so they can be updated properly. In your \os2\install directory, create a text file named userdirs that includes a line for each directory into which you've moved OS/2 files. If, for example, you moved all the applications to d:\apps, include the line D:\APPS* in the file.

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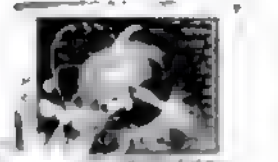
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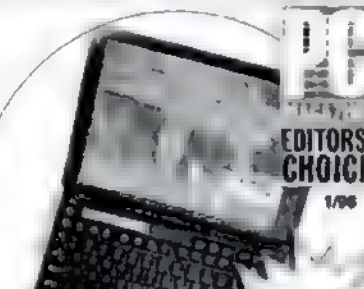
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Multiple Operating Systems Without Pain

I recently upgraded my PC and added a 340MB hard disk, so I now have a two-disk IDE system. I also plan to upgrade to DOS 6.22 and add Windows 3.1 to the second hard disk. But there's something else I want to do—run both DOS 5.0 and 6.22 on the same computer (never mind why). Can you tell me how to do this?

JOHN G. NAUMANN,
Arden Hills, Minnesota

PC MAGAZINE: I won't ask why; I'm the fellow who used to keep a stack of floppy disks on hand so I could boot into every possible DOS version. By booting from a floppy, I avoided dealing with multiple versions of the hidden system files MSDOS.SYS and IO.SYS. Unfortunately though, the more recent DOS versions are so very large that it's well-nigh impossible to use them after booting from a floppy.

Fortunately, there is a solution: V Communications (800-648-8226) publishes a \$99 utility called System Commander 2.0 that does precisely what you've asked and much more. You can boot into as many as 32 different operating systems or versions in a single DOS partition and up to 100 operating systems in total—if you can find that many! Besides managing multiple DOS versions, System Commander handles OS/2, Windows 95, Windows NT, SCO Unix, and many more. If that's not enough, it also protects your operating systems against unauthorized access and offers recovery from boot-sector viruses—all without tying up any of your precious memory.

—Neil J. Rubenking

A Panacea for Windows Ailments

I am encountering sporadic problems running software under Windows 3.1. I get GPFs in USER, GDI, and KERNEL, including:

- PW2 had an "unknown" fault at KERNEL.
- PW2 had an "exceed segment bounds (write)" fault at PW2.
- WINPROBE had an "exceed segment bounds (read)" fault at WINPROBE.

These are just a few examples from the Dr. Watson logs. Any program can cause an error. This has happened with Word for Windows, so it's not just non-Microsoft products. And it's happened in Program Manager as well as File Manager and in other Windows applications, even the Control Panel applets.

If I use a parameter of INT15=xxxx on the HIMEM.SYS statement, the errors go away. The problem is that the amount in the INT15 parameter keeps growing with hardware and software additions and changes. It is currently at

7,168K, almost half the available memory.

I've called Microsoft Windows support four times now, with no results. I've done a clean boot, run Windows in Standard mode, Excluded A000-FFFF, and reinstalled many times. I've even tried rebuilding my PROGMAN.INI file. Isn't there anything I can do to solve the problem?

BARR HAMILTON, via ZD Net

PC MAGAZINE: The fact that it helped to tweak HIMEM.SYS's INT15= parameter is probably a fluke. According to the Microsoft Developer's Network CD-ROM, "Windows in Standard and 386 Enhanced modes does not use INT15 for itself or for MS-DOS applications run from Windows." The INT15= switch is intended to provide compatibility with older applications.

Instead, set the MaxBPs= key in the [386Enh] section of SYSTEM.INI from the default value of 200 to 400; if that doesn't help, try 800. This setting determines the amount of memory Windows sets aside for *break points*, which are tiny blocks of memory used to save state information for Virtual Machines (VMs). Windows apps all run in a shared VM, each DOS app has its own VM, and Windows apps may spawn additional VMs.

When Windows runs out of break points, it doesn't pop up a nice message box warning you to increase the MaxBPs value. Instead, it starts emitting seemingly random General Protection Faults and other errors—just the symptoms you're experiencing. In general, when a Windows system is producing unpredictable errors, raising the MaxBPs= setting is the first thing to try.

Note that Windows actually allocates space for break points 4,096 bytes at a time. The default setting of 200 is rounded up to about 370, and no actual increase in the available break points occurs until you set a number that won't fit in 4K. Increasing the setting to 400 causes another 4K block to be allocated; raising it to 800 allocates a third 4K block.

—Neil J. Rubenking

WORD PROCESSING

Doing Double Strike in Windows



Once a month I publish a 12-page document and mail it to about 400 people. This amounts to roughly 5,000 pages, which I produce with a mimeograph machine. The problem is that in order to cut the stencil for the mimeograph machine, I need to use my printer's double-strike feature. I'm using an old DOS word processor now. I'd like to switch to a Windows word processor, but I can't find any that offer double strike. Is there a way to double strike in Windows?

GENE SCRAY, Ruston, Louisiana

PC MAGAZINE: There are several workarounds to Windows' lack of support for the double-strike feature in daisy wheel and a few dot matrix printers. But the simplest solution—and the one most likely to work—is to use a Windows word processor for creating the file and your DOS word processor for printing it.

If the DOS word processor you're using ever had a reasonable level of popularity, odds are very good that any Windows word processor you choose will be able to export to its format. That means you can prepare your document in Windows and use all the editing features of the Windows program before exporting it to the DOS word processor format. After exporting the file, you can open a DOS window, load the DOS word processor and the exported version of the file, add the command to double strike at the beginning of the file, and print.

One thing to keep in mind if you choose this route is that the more complicated the format of your document, the more likely you'll run into problems exporting the file to another file format. If you stay with a simple format, however, you shouldn't have any problems.—M. David Stone

SPREADSHEETS

Avoiding Zeros



Please satisfy my curiosity: Lotus provides financial templates for its 1-2-3 for DOS, Release 4. These templates use formulas like the following to sum columns:

```
@IF(@SUM(A1..A10),@SUM(A1..A10),"")
```

What is the purpose of the @IF? Why isn't the formula just @SUM(A1..A10)?

I've tried the formula both ways. I've deleted rows, erased numbers, and even put in error values. I get the same results with or without @IF. Why does Lotus use the longer formula?

JERRY TOBIAS, Clifton, New Jersey

PC MAGAZINE: To avoid zeros. The @IF construction says, "If the sum of A1 through A10 is anything nonzero, let me have it. Otherwise, give me a null string." Thus, if the target range is entirely blank, the long formula returns a null string, while the short version gives you a meaningless zero.

Note, however, that the @IF formula also returns a null string if the values in the target range happen to add up to zero. That is, the formula does not distinguish between significant and insignificant zeros. Here's a better way to deal with the possibility of blank ranges:

```
@IF(@COUNT(A1..A10),@SUM(A1..A10),"")
```

This formula returns a null string only if the target range has no populated cells.

—Craig Stinson

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32M1000 (2147483648Meg)	Model 25-286, 30 MTRB 80	53687091250.00
32M1000 (4294967296Meg)	Model 25-286, 30 MTRB 80	107374182450.00
32M1000 (8589934592Meg)	Model 25-286, 30 MTRB 80	214748364850.00
32M1000 (17179869184Meg)	Model 25-286, 30 MTRB 80	429496729650.00
32M1000 (34359738368Meg)	Model 25-286, 30 MTRB 80	858993459250.00
32M1000 (68719476736Meg)	Model 25-286, 30 MTRB 80	1717986918450.00
32M1000 (137438953472Meg)	Model 25-286, 30 MTRB 80	3435973836850.00
32M1000 (274877906944Meg)	Model 25-286, 30 MTRB 80	6871947673650.00
32M1000 (549755813888Meg)	Model 25-286, 30 MTRB 80	13743895347250.00
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32M1000 (2199023255552Meg)	Model 25-286, 30 MTRB 80	54975581388850.00
32M1000 (4398046511104Meg)	Model 25-286, 30 MTRB 80	109951162777650.00
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32M1000 (35184372888832Meg)	Model 25-286, 30 MTRB 80	879609302220850.00
32M1000 (70368745777664Meg)	Model 25-286, 30 MTRB 80	1759218644441650.00
32M1000 (14073749155328Meg)	Model 25-286, 30 MTRB 80	3518437288883250.00
32M1000 (28147498310656Meg)	Model 25-286, 30 MTRB 80	7036874577766450.00
32M1000 (56294996621312Meg)	Model 25-286, 30 MTRB 80	1407374915532850.00
32M1000 (112589993242624Meg)	Model 25-286, 30 MTRB 80	2814749831065650.00
32M1000 (225179986485248Meg)	Model 25-286, 30 MTRB 80	5629499662131250.00
32M1000 (450359972970496Meg)	Model 25-286, 30 MTRB 80	11258999324262450.00
32M1000 (900719945940992Meg)	Model 25-286, 30 MTRB 80	22517998648524850.00
32M1000 (1801439891881984Meg)	Model 25-286, 30 MTRB 80	45035997297049650.00
32M1000 (3602879783763968Meg)	Model 25-286, 30 MTRB 80	90071994594099250.00
32M1000 (7205759567527936Meg)	Model 25-286, 30 MTRB 80	180143989188198450.00
32M1000 (14411519135058752Meg)	Model 25-286, 30 MTRB 80	360287978376396850.00
32M1000 (28823038270117504Meg)	Model 25-286, 30 MTRB 80	720575956752793650.00
32M1000 (57646076540235008Meg)	Model 25-286, 30 MTRB 80	1441151913505875250.00
32M1000 (115292153080460032Meg)	Model 25-286, 30 MTRB 80	2882303827011750450.00
32M1000 (230584306160920064Meg)	Model 25-286, 30 MTRB 80	5764607654023500850.00
32M1000 (461168612321840128Meg)	Model 25-286, 30 MTRB 80	11529215308046003250.00
32M1000 (922337224643680256Meg)	Model 25-286, 30 MTRB 80	23058430616092006450.00
32M1000 (1844674449287360512Meg)	Model 25-286, 30 MTRB 80	46116861232184012850.00
32M1000 (3689348898574721024Meg)	Model 25-286, 30 MTRB 80	92233722464368025650.00
32M1000 (7378697797149442048Meg)	Model 25-286, 30 MTRB 80	184467444928736051250.00
32M1000 (14757395954298884096Meg)	Model 25-286, 30 MTRB 80	368934889857472102450.00
32M1000 (29514791908597768192Meg)	Model 25-286, 30 MTRB 80	737869779714944204850.00
32M1000 (59029583817195536384Meg)	Model 25-286, 30 MTRB 80	1475739595429888409650.00
32M1000 (118059167634391072768Meg)	Model 25-286, 30 MTRB 80	2951479190859776819250.00
32M1000 (236118335268782145536Meg)	Model 25-286, 30 MTRB 80	5902958381719553638450.00
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32M1000 (944473341075128582145536Meg)	Model 25-286, 30 MTRB 80	23611833526878214553650.00
32M1000 (188894668215025716582145536Meg)	Model 25-286, 30 MTRB 80	47223667053756429107250.00
32M1000 (3777893364300514314316582145536Meg)	Model 25-286, 30 MTRB 80	94447334107512858214553650.00
32M1000 (75557867286010286286316582145536Meg)	Model 25-286, 30 MTRB 80	18889466821502571658214553650.00
32M1000 (15111573457202057257286286316582145536Meg)	Model 25-286, 30 MTRB 80	377789336430051431431658214553650.00
32M1000 (3022314691440411451457286286316582145536Meg)	Model 25-286, 30 MTRB 80	7555786728601028628631658214553650.00
32M1000 (604462938288082290291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	1511157345720205725728628631658214553650.00
32M1000 (120892587677616458058291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	302231469144041145145728628631658214553650.00
32M1000 (24178517535523291611658291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	60446293828808229029145728628631658214553650.00
32M1000 (48357035071046583223291611658291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	12089258767761645805829145728628631658214553650.00
32M1000 (967140701420931664583223291611658291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	2417851753552329161165829145728628631658214553650.00
32M1000 (1934281402841823328583223291611658291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	4835703507104658322329161165829145728628631658214553650.00
32M1000 (386856280568364665664583223291611658291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	96714070142093166458322329161165829145728628631658214553650.00
32M1000 (773712561136729331328583223291611658291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	193428140284182332858322329161165829145728628631658214553650.00
32M1000 (154742512273458666664583223291611658291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	38685628056836466566458322329161165829145728628631658214553650.00
32M1000 (309485024546913333328583223291611658291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	77371256113672933132858322329161165829145728628631658214553650.00
32M1000 (61897004909382666664583223291611658291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	154742512273458666666458322329161165829145728628631658214553650.00
32M1000 (1237940098187753333328583223291611658291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	30948502454691333332858322329161165829145728628631658214553650.00
32M1000 (247588019637550666664583223291611658291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	61897004909382666666458322329161165829145728628631658214553650.00
32M1000 (4951760392751013333328583223291611658291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	123794009818775333332858322329161165829145728628631658214553650.00
32M1000 (990352078550202666664583223291611658291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	24758801963755066666458322329161165829145728628631658214553650.00
32M1000 (1980704157004053333328583223291611658291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	495176039275101333332858322329161165829145728628631658214553650.00
32M1000 (396140831400810666664583223291611658291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	99035207855020266666458322329161165829145728628631658214553650.00
32M1000 (7922816628016213333328583223291611658291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	198070415700405333332858322329161165829145728628631658214553650.00
32M1000 (1584563253603242666664583223291611658291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	39614083140081066666458322329161165829145728628631658214553650.00
32M1000 (3169126507206485333328583223291611658291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	792281662801621333332858322329161165829145728628631658214553650.00
32M1000 (633825301441297066664583223291611658291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	158456325360324266666458322329161165829145728628631658214553650.00
32M1000 (12676506028825941333328583223291611658291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	316912650720648533332858322329161165829145728628631658214553650.00
32M1000 (2535301205765188266664583223291611658291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	63382530144129706666458322329161165829145728628631658214553650.00
32M1000 (507060241153037666664583223291611658291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	1267650602882594133332858322329161165829145728628631658214553650.00
32M1000 (10141204823061541333328583223291611658291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	253530120576518826666458322329161165829145728628631658214553650.00
32M1000 (202824096461228266664583223291611658291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	50706024115303766666458322329161165829145728628631658214553650.00
32M1000 (4056481929224565333328583223291611658291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	1014120482306154133332858322329161165829145728628631658214553650.00
32M1000 (811296385844913066664583223291611658291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	20282409646122826666458322329161165829145728628631658214553650.00
32M1000 (1622592716898261333328583223291611658291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	405648192922456533332858322329161165829145728628631658214553650.00
32M1000 (324518543379652266664583223291611658291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	81129638584491306666458322329161165829145728628631658214553650.00
32M1000 (6490370867593045333328583223291611658291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	162259271689826133332858322329161165829145728628631658214553650.00
32M1000 (129807417351809066664583223291611658291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	32451854337965226666458322329161165829145728628631658214553650.00
32M1000 (2596148347036181333328583223291611658291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	649037086759304533332858322329161165829145728628631658214553650.00
32M1000 (519229669407236266664583223291611658291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	12980741735180906666458322329161165829145728628631658214553650.00
32M1000 (1038459338814725333328583223291611658291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	259614834703618133332858322329161165829145728628631658214553650.00
32M1000 (207691867762945066664583223291611658291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	51922966940723626666458322329161165829145728628631658214553650.00
32M1000 (4153837355258901333328583223291611658291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	103845933881472533332858322329161165829145728628631658214553650.00
32M1000 (830767471051780266664583223291611658291457286286316582145536Meg)	Model 25-286, 30 MTRB 80	20769186776294506666458322329161165829145728628631658214553650.00
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```
method pushButton(var eventInfo Event)
var
    tsPrn TextStream           ; Printer textStream
    tcTable TCursor           ; TCursor for table
    sPrintline String         ; String that holds print line
endvar

tsPrn.open("prn","w")         ; Open the printer for writing

tcTable.open("Cust.db")       ; Open the Cust table

Scan tcTable :                ; Loop through the entire table

    ; Construct a "label" by placing the data and special characters
    ; in the sPrintline string

    sPrintline = "\n\n" + tcTable."Name" + "\n\r" + tcTable."Street" +
        "\n\r" + tcTable."City" + ", " + tcTable."State/Prov" + " " +
        tcTable."Zip/Postal Code" + "\n\r" + tcTable."Country" + "\n\n\n\r"

    tsPrn.WriteLine( sPrintline ) ; Write the string to the printer

endScan

tcTable.close()               ; Close the table
tsPrn.close()                 ; Close the printer

endmethod
```

FIGURE 3: The `pushButton` method shown here demonstrates how to send data directly to the printer from Paradox for Windows by opening and writing to the printer device as a file.

DATABASES

Sending Data Directly To the Printer in Paradox for Windows



A number of my clients regularly need to print mailing labels on dot matrix printers from their Paradox for Windows databases. But some versions of Windows don't print very fast on these printers, and some drivers don't support mailing labels very well. My solution is to bypass the Windows printer driver and output directly to the printer from Paradox for Windows.

Figure 3 shows sample code that demonstrates the technique. The sample assumes you're going to initiate printing by pressing a button on a form, so the code is placed in the button's `pushButton` method.

TONY BOXER, Fremont, California

PC MAGAZINE: The key point Mr. Boxer's technique illustrates is that you can open a device as a file and then write to it. Thus, you can open the printer device as a file and write lines to it to create the labels, bypassing the Windows printer driver and sending data directly to your printer.

The ability to open a device as a file has been around ever since Microsoft introduced device drivers back in MS-DOS 2.0. A device driver provides an interface between the operating system and a peripheral device such as a printer or hard disk, relieving the operating system of the burden of dealing with the specifics of a particular device. The operating system employs a standard interface between itself and the device driver so that the driver alone handles the hardware specifics.

You install hardware-specific device drivers by placing a line in your CONFIG.SYS file or by having Windows load a .VXD file (this is usually set up automatically by an installation program). But since MS-DOS 2.0, several standard devices have been predefined and are installed automatically whenever you boot your PC. Among these are the system console (your display), called CON, and the printer, called PRN. The operating system treats these devices the same way it treats files. For example, you can use the COPY command to copy a file to your printer, just as you'd copy one file to another file. You simply substitute the name of the printer device, PRN, in place of a filename as the destination.

In Paradox for Windows 5.0, you use a TextStream object to read and write ASCII files. And, as Mr. Boxer discovered, you can also open the PRN device as a TextStream and then write to it.

In the listing in Figure 3, you'll notice the use of `\n` and `\r` to insert newline and carriage-return characters in the text string. You include the newline character to advance the printer to the next line while maintaining the same column position and the carriage-return character to position the printer to the left margin of the current line. The characters are used just for positioning—neither actually prints anything. Some printers automatically move to the first printable position on a line after processing a line-feed character. In that case the carriage return is unnecessary. You'll need to experiment with your own printer to determine what works for you.

Note that you can send control-code sequences to your printer to invoke special printer functions (look in your printer documentation to find out what sequences your printer will accept). For instance, the control-code sequence to switch an HP LaserJet Series II printer to the Line Printer typeface is 27, 40, 115, 48, 84. To add this sequence to `sPrintline`, you could use the `+` operator and the `chr()` function to concatenate the additional characters like this:

```
sPrintline = sPrintline + chr(27) +
    chr(40) + chr(115) + chr(48) +
    chr(84)
```

Paradox for Windows also lets you send control codes by enclosing the value in quotes and preceding it with a backslash. For example, to send a form feed to the printer, you could add `"\12"` to the print line like this:

```
sPrintline = sPrintline + "\12"
```

The `chr()` technique is more familiar, though, to people coming from some other programming languages like Basic or Xbase.

—Sal Ricciardi

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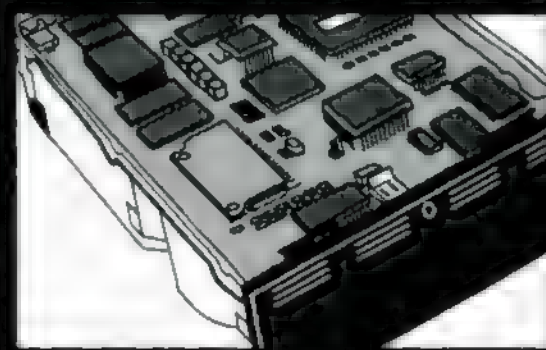
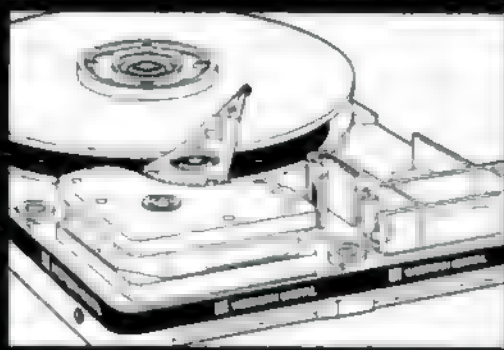


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IBM® ThinkPad® 701C Series

◆ IntelDX4™ 75MHz or IntelDX2™ 50MHz CPU
◆ 8MB RAM std., 24MB max. (IntelDX4 models)
◆ 4MB RAM std., 20MB max. (IntelDX2 models)
◆ 10.4" active-matrix (701C) or dual-scan (701CS) color display ◆ Lightweight and compact, 4.5 lbs., 9.7" x 7.9" x 1.7"

IntelDX4 models
701C 360MB hard drive
\$1999.99*
CDW 51792

701CS 540MB hard drive
\$2789.00
CDW 51795



701C 540MB hard drive
\$3299.00
CDW 51793

IntelDX2 model
701C 360MB hard drive
\$1899.00
CDW 51788

*Special purchase, supplies are limited!

NEC

CDW Blowout!



NEC Versa™ V/50C

Our lowest price ever on **NEC Versa notebooks!**

◆ SL-enhanced IntelDX2™ 50MHz CPU
◆ 4MB RAM std., 20MB max
◆ 340MB hard drive ◆ 9.5" active-matrix color display ◆ PCMCIA slots 2) Type II or 1) Type III

\$1499.00 CDW 54301

Hurry, supplies are limited!

IBM® ThinkPad® 365 Series

Powerful, flexible and affordable

◆ DX4 75MHz processor ◆ 8MB RAM std., 24MB max. ◆ 540MB hard drive ◆ 10.4" actual viewable active-matrix color display (365C models) or ◆ 10.4" actual viewable dual-scan color display (365CS, 365CD, 365CSD models) ◆ Double-speed CD-ROM (365CD, 365CSD models) ◆ Pre-loaded software: OS/2/Windows 3.11 or Windows 95 ◆ 1 year international warranty

365CS OS/2/WIN 3.11.....**\$1999.00** CDW 60139

365CSD OS/2/WIN 3.11.....**\$2499.00** CDW 60141

365CSD WIN 95.....**\$2499.00** CDW 60146

365C OS/2/WIN 3.11.....**\$2599.00** CDW 60137

365CD WIN 95.....**\$3099.00** CDW 60145



NEW!



TEXAS INSTRUMENTS

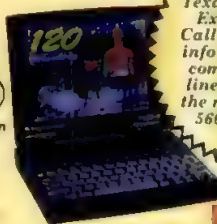
TravelMate 5200 and 5100

Intel Pentium® processor power and PCI bus

◆ 120MHz (TM5200) or 90MHz (TM5100) Intel Pentium® processor
◆ 256KB L2 cache, full 64-bit memory system ◆ 8MB RAM std., 32MB max.
◆ 1.2GB hard drive ◆ 32-bit PCI local bus architecture ◆ 33MHz ◆ PCI local bus video, 2MB video RAM ◆ 3 year parts and labor warranty

TM5200
10.4" active-matrix display **\$4975.74** CDW 62496

TM5100
10.4" active-matrix display **\$4216.27** CDW 56585



Looking for Texas Instruments Extensa Series? Call CDW today for information on the complete Extensa line up, including the new 560CD and 560CDT models.



TM5200

COMPAQ Contura 400 Series

The perfect combination of affordability and performance

◆ 420: IntelDX4™ 75MHz CPU ◆ 430 IntelDX4™ 100MHz CPU ◆ 8MB RAM std., 32MB max. ◆ Weight 6.25 lbs. ◆ 3 year limited warranty

420C, 420MB hard drive, 10.4" dual-scan color display **\$2117.00** CDW 56255

420CX, 420MB hard drive, 10.4" active-matrix color display **\$2599.00** CDW 56256

430C, 720MB hard drive, 10.4" dual-scan color display **\$2408.00** CDW 56257

430CX, 720MB hard drive, 10.4" active-matrix color display **\$2979.00** CDW 56259



COMPAQ LTE Elite

◆ IntelDX4™ 75MHz processor
◆ 9.5" dual scan color display ◆ 8MB RAM std., 32MB max. ◆ Integrated AC adaptor ◆ Weight: 6.73 lbs. ◆ 3 year limited warranty

340MB hard drive **\$2788.00** CDW 52498

510MB hard drive **\$3169.00** CDW 52499



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transparencies, even fabric • Paper handling: 100
sheets letter or legal, 15 env. • Includes Canon
Creative CD-ROM • Parallel interface

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Large screen
performance at an
affordable price

- ✓ 17" diagonal (15.6" viewable) flat square CRT
- ✓ .28mm dot pitch high-contrast anti-static screen
- ✓ Maximum resolution: 1280 x 1024, non-interlaced
- ✓ Refresh: up to 76Hz at 800 x 600, 76Hz at 1024 x 768, 60Hz at 1280 x 1024
- ✓ Plug And Play (PnP) compatible
- ✓ VESA DPMS compatible, MPR II and Energy Star compliant
- ✓ 3 year warranty

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CDW 51891

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T2130CS DX4/75 500MB pas color 12.99
T2130CT DX4/75 500MB act color 13.99
T2130CTS DX4/75 500MB pas color CD 14.99
Portege 610CT 5/90 720MB act color 15.99
410CS 5/90 8MB 720MB pas color 16.99
410CT 5/90 8MB 720MB act color CD 17.99
Tetra 700CS 5/120 8MB 1.2GB pas color 18.99
Tetra 700CT 5/120 16MB 1.2GB act color 19.99

AST

Advantage! portables
Explorer 4/100 8MB 540MB act color 20.99
Ascentia portables
Ascentia 950A 5/75 500MB act color 21.99
Ascentia 950A 5/75 800MB act color 22.99
Ascentia 950A 5/75 1.2GB act color 23.99
Ascentia 950A 5/75 800MB act color 24.99
Ascentia 950A 5/75 1.2GB act color 25.99

Advantage! Adventure desktops

Advantage! 614 5/100 850MB 8MB CD 11.99
Advantage! 812 5/100 1.2GB 8MB CD 12.99
Advantage! 814 5/100 1.2GB 16MB CD 13.99
Advantage! 816 5/100 1.6GB 16MB CD 14.99
Advantage! 818 5/100 1.6GB 32MB CD 15.99
AST Bravo desktops
Bravo 5/75 850MB 8MB WIN95 11.99
Bravo 5/100 850MB 8MB WIN95 12.99
Bravo 5/120 1.2GB 16MB WIN95 13.99
Bravo 5/133 1.6GB 16MB WIN95 14.99

COMPAQ

COMPAQ PORTABLES

Contura 420C 4/75 8MB 420MB dual scan 11.99
Contura 420C 4/75 8MB 420MB act color 12.99
Contura 430C 4/100 8MB 720MB dual scan 13.99
Contura 430C 4/100 8MB 720MB act color 14.99
LTE Elite 4/75C 4/75 8MB 420MB dual scan 15.99
LTE Elite 4/75C 4/75 8MB 510MB dual scan 16.99

COMPAQ DESKTOPS

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ProLinea 575e 5/75 8MB 1.0GB 12.99
ProLinea 5100e 5/100 8MB 630MB 13.99
ProLinea 5100e 5/100 8MB 1.0GB 14.99
ProLinea 5120e 5/120 8MB 630MB 15.99
ProLinea 5120e 5/120 8MB 1.0GB 16.99
ProLinea 575 5/75 8MB 630MB 17.99
ProLinea 575 5/75 16MB 1.0GB 18.99
ProLinea 5100 5/100 8MB 630MB 19.99
ProLinea 5100 5/100 16MB 1.0GB 20.99
ProLinea 5120 5/120 16MB 1.0GB 21.99

ProLinea Series Mini-Towers

ProLinea 575 MT 5/75 8MB 630MB 11.99
ProLinea 575 MT 5/75 16MB 1.0GB 12.99
ProLinea 5100 MT 5/100 16MB 1.0GB 13.99
ProLinea 5133 MT 16MB 1.0GB 14.99

Desktop Series Desktops

Desktop 575 5/75 8MB 630MB 11.99
Desktop 575 5/75 16MB 1.0GB 12.99
Desktop 580 5/90 8MB 630MB 13.99
Desktop 580 5/90 16MB 1.0GB 14.99
Desktop 5100 5/100 8MB 630MB 15.99
Desktop 5100 5/100 16MB 1.0GB 16.99
Desktop 5120 5/120 16MB 1.0GB 17.99
Desktop 5133 5/133 16MB 1.0GB 18.99

Desktop Series Mini-Towers

Desktop 575 MT 5/75 8MB 630MB 11.99
Desktop 575 MT 5/75 16MB 1.0GB 12.99
Desktop 590 MT 5/90 8MB 630MB 13.99
Desktop 590 MT 5/90 16MB 1.0GB 14.99
Desktop 5100 MT 5/100 16MB 1.0GB 15.99
Desktop 5133 MT 5/133 16MB 1.0GB 16.99

NEC

Versa V 4/50 4MB 250MB act color 11.99
Versa V 4/50 4MB 340MB act color 12.99
Versa 2000 4/75 4MB 350MB act color 13.99
Versa 2000 4/75 8MB 350MB act color 14.99
Versa 2000C 4/75 8MB 350MB act color 15.99
Versa 4000 5/75 540MB dual color 16.99
Versa 4000C 5/75 720MB act color 17.99
Versa 4050C 5/90 720MB act color CD 18.99
Versa 4050C 5/90 810MB hi-res color 19.99

COMPUTERS

multimedia mini-towers

911 5/75 8MB 1.2GB CD WIN95 11.99
917 5/100 8MB 1.2GB CD WIN95 12.99
933 5/100 16MB 1.6GB CD WIN95 13.99
940 5/133 16MB 1.2GB CD WIN95 14.99

ThinkPad portables

365CS 4/75 8MB 540MB pas color 11.99
365C 4/75 8MB 540MB act color 12.99
365CSD 4/75 540MB pas color color 13.99
365C 4/75 8MB 540MB act color CD 14.99
701C DX4/75 540MB act color 15.99
701CS DX4/75 540MB pas color 16.99
701C DX4/75 360MB act color 17.99
755C DX4/100 810MB act color 18.99
755C (SBU) 5/75 540MB act color 19.99
755C 4/100 540MB act color 20.99
755C 4/100 810MB act color CD 21.99
760C 5/90 8MB 720MB 10.4 act color 22.99
760C 5/90 8MB 720MB 12.1 act color 23.99
760C 5/120 8MB 720MB 12.1 act color 24.99
760C 5/90 8MB 1.2GB 12.1 act color 25.99

PC300/700 Series desktops

PC300 5/90 8MB 540MB 11.99
PC300 5/90 16MB 850MB 12.99
IBM PC300 5/75 8MB 13.99
PC350 5/75 16MB 850MB 14.99
PC350 5/90 16MB 850MB 15.99
PC750 5/90 16MB 540MB 16.99
PC750 5/133 16MB 1GB 17.99

TEXAS INSTRUMENTS

Extensa 450 DX4/75 340MB dual color 11.99
Extensa 450T DX4/75 340MB act color 12.99
Extensa 550 5/75 524MB dual color 13.99
Extensa 550C 5/75 524MB dual color CD 14.99
Extensa 550C 5/75 524MB act color 15.99
Extensa 560C 5/75 524MB dual color 16.99
Extensa 560C 5/75 524MB act color 17.99
Extensa 560C 5/75 524MB act color CD 18.99
Extensa 560C 5/75 524MB act color 19.99
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PRINTERS

184 Turbo 225.07 ML591
ML320 319.20 Pacemark 3410
ML321 449.70 QL600e
ML380 224.45 QL106PS
ML395 999.19 QL810E
ML520 385.15 QL1020
ML521 499.84 OKJET 2010
OKI 2010

Canon

BJ30 mono 259.88 BJC610
BJC70 color 355.65 BJC4100
BJG210

EPSON

LX300 168.82 DFX5000 Plus
LQ570 246.86 DFX8000
F870 289.16 Stylus Color IIS
FX1170 377.51 Stylus Color IIS
LQ1070 384.00 Stylus Color Pro
LQ1070 444.14 Stylus Color Pro XL
LQ1170 987.85 Accolite Laser 1100
LQ2550

LEYMARK LASER PRINTERS

WinWriter 150c Thermal Inkjet
4030 10 Plus 10ppm
Optra R Plus 16ppm
Optra R Plus 16ppm 2 paper trays
Optra LX Plus 16ppm
Optra LX Plus 16ppm
Optra C color laser

Panasonic

1150 133.57 2135 Color
2023 182.98 3123
2130

TEXAS INSTRUMENTS

microLaser 600
microLaser Pro 600 PS23
microLaser Pro E
microLaser PowerPro12
microLaser Pro8
microLaser Win4

HEWLETT PACKARD

DeskJet 340 portable
DeskJet 560C
LaserJet 4v
LaserJet 5L
LaserJet Color
OfficeJet inkjet fax/copier/printer

COSTAR

LabelWriter XL WIN
LabelWriter XL Plus WIN

HARD DRIVES & CONTROLLERS

Maxtor

850MB Fast ATA
1.6GB Fast ATA

MICROPOLIS

4221 2GB SCSI-2
1936 3GB SCSI-2
1936AV 3.02GB Fast SCSI-2
3243 4.3GB SCSI-2

CONNER

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635MB EIDE
850MB Fast ATA
1.27GB Fast ATA

Seagate

428MB Fast ATA
545MB Fast ATA
1GB Fast ATA
1GB Fast SCSI-2

WESTERN DIGITAL

Caviar 635MB EIDE
Caviar 835MB EIDE
Caviar 1GB EIDE
Caviar 1.2GB EIDE
Caviar 1.62GB EIDE

CONTROLLERS

AcuLogic SIDE-3+ w/on-board BIOS
AcuLogic SIDE-4+ w/zip 2ser. game
AcuLogic SIDE-40E 18550 serial
Adaptec 1542CP SCSI Master Kit
Adaptec AHA1505 SCSI-2 CD Kit
Adaptec 2842 VLB SCSI-2
Adaptec PCI Ultra Wide SCSI Kit
Promise 2300C-EIDE VLB

MODEMS & COMMUNICATIONS

BOCA

Online Express 14.4 internal w/fax
Online Express 14.4 external w/fax
V 34 28.8 internal w/fax
V 34 28.8 external w/fax

Hayes

ACCURA 144 internal w/fax
ACCURA 144 external w/fax
ACCURA 288 V 34 internal w/fax
ACCURA 288 V 34 external w/fax
OPTIMA 144 external w/fax
OPTIMA 288 V 34 internal w/fax
OPTIMA 288 V 34 external w/fax
OPTIMA 288 V 34 Bus Modem and w/fax

PRACTICAL PERIPHERALS

14.4 internal w/fax
14.4 Mini Tower w/fax
V 34 28.8 internal w/fax
V 34 28.8 Mini Tower w/fax

MICROCOM

DeskPorte Fast ES V 34 28.8
DeskPorte 28.8 BP V 34

MODEMS & COMMUNICATIONS

MOTOROLA

Lifestyle 28.8 int. w/fax, Caller ID
Lifestyle 28.8 ext. w/fax, Caller ID
Power 28.8 ext. w/fax, Caller ID
BSURFPA Pro ISDN terminal adapter

PUREDATA

SatsFaxBox 400 internal
SatsFaxBox 400e external

Robotics

SPORTSTER MODEMS

14.4K internal w/fax
14.4K external w/fax
28.8K V 34 internal w/fax
28.8K V 34 external w/fax
V 14.4K internal w/fax & voice
V 14.4K external w/fax & voice
V 28.8K V 34 internal w/fax & voice
V 28.8K V 34 external w/fax & voice
V DSV2 V 34 internal w/fax & voice
V DSV2 V 34 external w/fax & voice

COURIER MODEMS

V 34 internal w/fax
V 34 external w/fax

ZOOM

V 34 FaxModem internal
V 34 FaxModem external
Voice FaxModem V17P 14.4VH internal
14.4 V 32bps w/fax internal
14.4 V 32bps w/fax external

BATTERY BACKUP AND UPS

AMERICAN POWER

Back UPS Pro 280 Plug and Play
Back UPS Pro 420 Plug and Play
Back UPS Pro 650 Plug and Play
SmartUPS 700
SmartUPS 1000
SmartUPS 1400
SurgeArrest Network
SurgeArrest Pro
SurgeArrest Network + Phone
Line R 600

TRIPLITE

BC 750 100
BC 750 200
BC PERS 500
BC PRO 675
BC PRO 1000
BC PRO 1500

TRIPLITE SMART UPS SERIES

SMART 250 LAN
SMART 450 LAN
SMART 675 LAN
SMART 850 LAN
SMART 1050 LAN
Isobar 4 OUTLET
Isobar 6 OUTLET

PCMCIA CARDS

3Com Ethernet III PCMCIA
3Com Ethernet III combo
Adaptec APA1460 SCSI-2
Hayes EZJack 14.4 w/fax
Hayes EZJack V 34 w/fax
IBM Token Ring 16/4
Linksys Ethernet combo
Megahertz XJack 14.4 data/fax
Megahertz XJack Good 14.4 data/fax
Megahertz V 34 data/fax w/ XJack
Megahertz 10BT Enet adapter w/ XJack
Megahertz card ready 28.8 Enet w/ XJack
Motorola Lifestyle 28.8 data/fax
Motorola Marquis 28.8 data/fax & LAN
New Media Bus Toaster SCSI-2 host
New Media Wave Jammer sound card
Simple Tech 14.4K modem + voice
Simple Tech SCSI adapter
Simple Tech 170MB hard drive
SMC Elite Ethernet combo
SyQuest SQ1100
USR Sportster 14.4K
Xirc Sportster V 34 with DataView
Xirc Ethernet 10BT
Xirc Ethernet combo
Xirc Ethernet-modem 10BT
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Portégé 610CT

Portégé 610CT

- Pentium 90MHz processor
- 9.5" True Color display for optimum color
- Built-in 16-bit sound (SoundBlaster Pro compatible), microphone & speaker
- Lithium ion battery technology
- Accupoint stick for easy control

Processor	Screen	MB	Price
Pentium 90MHz	9.5" True Color	720MB	\$3939

Tecra 700

120MHz
Pentium
with PCI bus

WIN95
INSTALLED

- PCI bus architecture (internal & external)
- 11.3" 800x600 high-resolution display
- Optional X-CD-ROM Drive (swap floppy & CD-ROM)
- Multimedia locking station with PCI bus
- Optional access to priced separately
- Built-in 16-bit sound and microphone
- 2 speakers & MIDI
- HUGE 1.1GB hard drives

Processor	Screen	MB	Price
Pentium 120	11.3" Dual Scan	1.13GB	\$4679
Pentium 120	11.3" Active	1.13GB	\$949



Tecra 700

Satellite 2110/2130

Processor	Screen	MB	Price
486DX4/75	10.4" Dual Scan	330MB	\$1679
486DX4/75	10.4" Dual Scan	500MB	1969
486DX4/75	10.4" Active	500MB	2499

Satellite 2110/2130



Satellite Pro 410

Satellite Pro 410

- Built-in X-CD-ROM Drive (swap floppy & CD-ROM)
- Active models only - optional on Dual Scan
- Built-in 16-bit sound, microphone, speaker & MIDI
- 100MB RAM memory, exp. to 40MB (Sat. Pro 410 only)
- Built-in Modem - small, sleek design & reduced weight
- Integrated Accupoint - small, accurate & easy to use
- Lithium ion battery technology
- Built-in antenna for wireless communications

Processor	Screen	MB	Price
Pentium 90	11.3" Dual Scan	772MB	\$3499
Pentium 90	11.3" Active	772MB	4679

IBM®



ThinkPad® 365

- 10.4" Active & 10.4" Dual Scan
- Built-in infrared for no-hassle printer connections
- Multimedia models include built-in 2X CD-ROM, SoundBlaster compatible audio, speaker, microphone & MIDI joystick port
- MS Windows 95 or Selecta System models available

Processor	Screen	MB	Price
486DX4/75	10.4" Dual Scan	540MB	\$1999
486DX4/75	10.4" Active	540MB	2599
486DX4/75	10.4" Dual Scan	540MB	2499*
486DX4/75	10.4" Active	540MB	3099*

*Multimedia Models

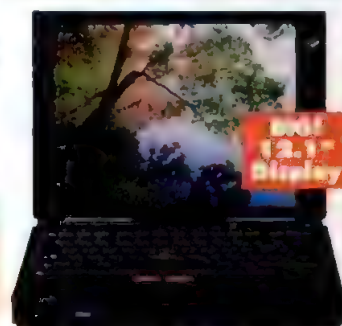
ThinkPad® 365CD

ThinkPad® 760

- Up to 120MHz Pentium with 32-bit local bus
- 12.1" Active displays with 800x600 resolution (selected models)
- 4X CD-ROM Drive, MPEG-2 support, & full motion video (ThinkPad 760CD only *)
- Built-in 28.8 fax/modem
- SoundBlaster compatible audio & telephony
- Lithium ion battery technology

Processor	Screen	MB	Price
Pentium 90	10.4" Active	720MB	\$5349
Pentium 90	12.1" Active	720MB	6049
Pentium 120	12.1" Active	720MB	6599
Pentium 90	12.1" Active	1.2GB	7449*

*Features built-in CD-ROM drive
WIN 95 models available. Call for details.



ThinkPad® 760CD

hp HEWLETT® PACKARD



HP OmniBook 600

- Weighs **ONLY 3.8 pounds!**
- Built-in 16-bit sound, microphone & speaker (active model only)
- Built-in infrared for no-hassle printer connections
- Lithium ion battery technology
- Instant ON - ready to work state lasts for months on a charge

Processor	Screen	MB	Price
486DX4/75	9.5" Dual Scan	340MB	\$2539
486DX4/75	9.5" Active	340MB	2999

HP OmniBook 600 NoteBook PC

HP OmniBook 5000

- Up to 120MHz Pentium with 32-bit PCI Local Bus
- 1.2GB drives available for high capacity storage
- High resolution - 800x600 resolution on notebook display
- Built-in 16-bit sound, microphone & speaker

Processor	Screen	MB	Price
Pentium 90	10.4" Active	1.2GB	\$5329
Pentium 90	10.4" Active	1.2GB	5889*
Pentium 120	10.4" Active	1.2GB	6539

*16MB RAM standard



HP OmniBook 5000 NoteBook PC

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**TEXAS
INSTRUMENTS**

Extensa 560CD/560CDT

- 75MHz Pentium w/PCI bus & 256KB cache
- Built-in 4X CD-ROM drive
- Built-in 16-bit sound, microphone & speaker
- Integrated touchpad pointer
- 10.4" Active Matrix & 10.4" Dual Scan
- Built-in infrared for wireless communications

Processor	Screen	RAM	Price
Pentium 75	10.4" Dual Scan	810MB	CALL CALL
Pentium 75	10.4" Active	1.2GB	

**75MHz
Pentium
with PCI BUS**



Extensa 560 Product differs slightly from photo

**WIN95
INSTALLED**

**PC
EDITORS
CHOICE**

TravelMate 5000/5100

- Up to 120MHz Pentium with PCI Bus to optimize Pentium processor performance
- 10.4" Active Matrix display with 2MB Video RAM
- 10.5" Dual Scan display with 2MB Video RAM
- 65K colors on notebook display
- 16-bit Sound Card, Speaker, Microphone & MIDI
- Upgradable hard drive - easily add more storage
- Built-in Dual Lithium Ion batteries
- Built-in infrared for no-hassle printer connections

Processor	Screen	RAM	Price
Pentium 120	10.4" Active	1.2GB	\$5099

TravelMate 5000

Extensa 550

- Pentium 75MHz w/PCI bus
 - 10.4" Dual Scan
 - 524MB Hard Drive
- Only \$2499**

NEC

Versa 2000

Processor	Screen	RAM	Price
486DX4/75	9.5" Active	350MB	\$2099*
486DX4/75	9.5" Active	350MB	2399
486DX4/75	9.5" Active	540MB	2599

*14.4 fax/modem not built-in



NEC Versa 4000

NEC Versa 4000

- Built-in CD-ROM Drive (standard on some models, optional on others)
- Pentium™ 75 and Pentium 90 processors
- 256KB Level 2 Cache to optimize performance
- Unbelievable displays - 65K color Dual Scan, 16.8 million color Active (High resolution Active Matrix displays available - 800x600 res.)
- Built-in 16-bit sound, microphone, MIDI and 2 built-in speakers
- Multimedia docking station with outstanding Altec Lansing® speaker array (optional accessories, priced separately)

NEW 120MHz Pentium Model!

Processor	Screen	RAM	Price
Pentium 75	10.4" Dual Scan	540MB	\$3499
Pentium 75	10.4" Dual Scan	540MB	3799*
Pentium 75	10.1" Active	540MB	3999
Pentium 90	10.1" Active	810MB	4649*
Pentium 90	10.4" High Res.	810MB	4799
Pentium 120	10.4" High Res.	1GB	5499

* Features built-in CD-ROM drive

COMPAQ

Contura 420/430

Processor	Screen	RAM	Price
486DX4/75	10.4" Dual Scan	420MB	\$2089
486DX4/75	10.4" Active	420MB	2559
486DX4/100	10.4" Dual Scan	720MB	2369
486DX4/100	10.4" Active	720MB	2939

LTE 5000 Series

- Up to 120MHz Pentium power w/PCI bus & 256KB cache
- 32-bit PCI Local bus graphics
- 8MB RAM exp. to 72MB
- Built-in 16-bit sound, microphone & 2 speakers
- MultiBay - holds CD-ROM, 2nd HDD, Floppy, or 2nd battery
- Up to 1.35GB hard drives (2.7GB max. capacity)
- Built-in infrared for wireless communications
- Supports NiMH & Lithium Ion batteries (up to 8 hrs.)
- Optional MPEG and TV video adapter

Processor	Screen	RAM	Price
Pentium 75	10.4" Dual Scan	510MB	\$3799
Pentium 75	11.3" Dual Scan	810MB	4439
Pentium 75	10.4" Active	810MB	4729
Pentium 90	10.4" Active	810MB	5339
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Minitower (7022)	Pentium 75	1GB	\$1699
Minitower (9022)	Pentium 100	1GB	1999
Minitower (9522)	Pentium 100	1.6GB	2499*
Minitower (9532)	Pentium 120	1.6GB	2699*
Minitower (9542)	Pentium 133	1.6GB	2999*

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- SDR graphics (selected models only)
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Desktop (626)	Pentium 33	1.2GB	2140+
Desktop (628)	Pentium 150	1.6GB	2400+0
Minitower (822)	Pentium 100	1.2GB	2000+
Minitower (824)	Pentium 133	1.6GB	2400+0
Minitower (824)	Pentium 150	2.1GB	2680+0**
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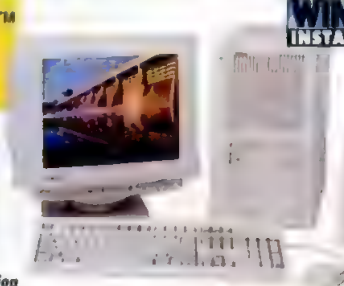


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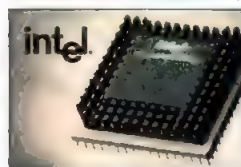
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1

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2

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7

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3

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6

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4

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5

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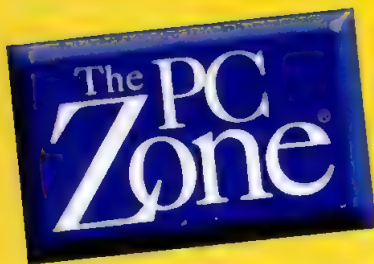
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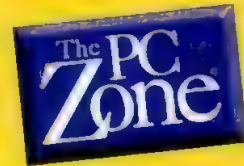
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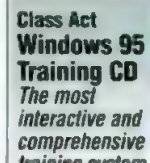
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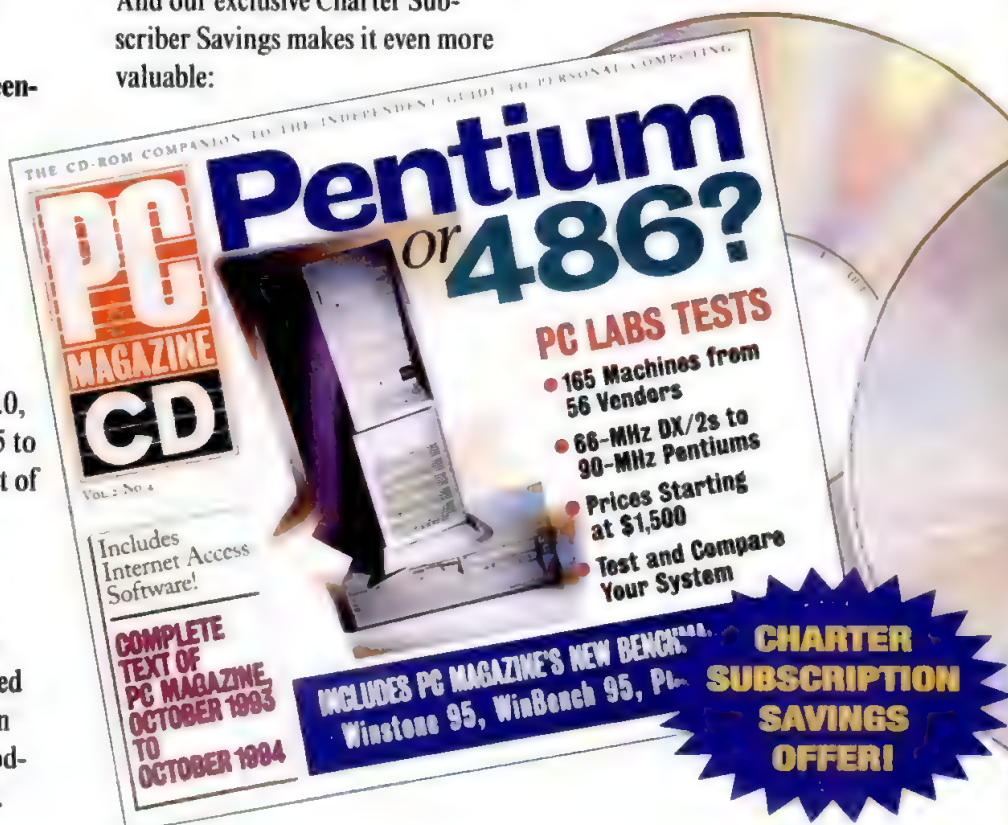
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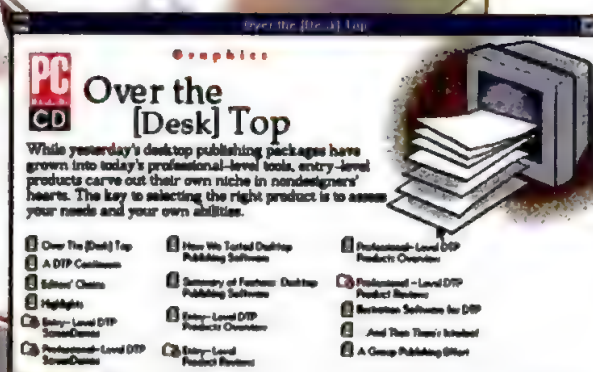
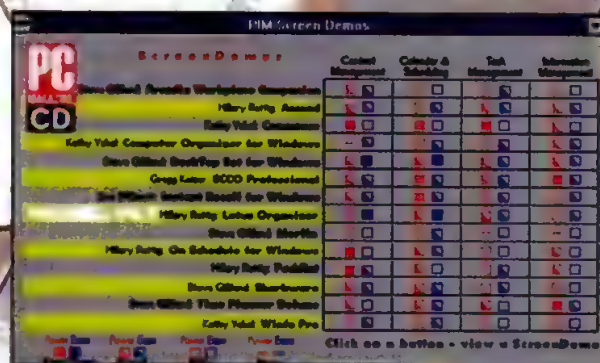
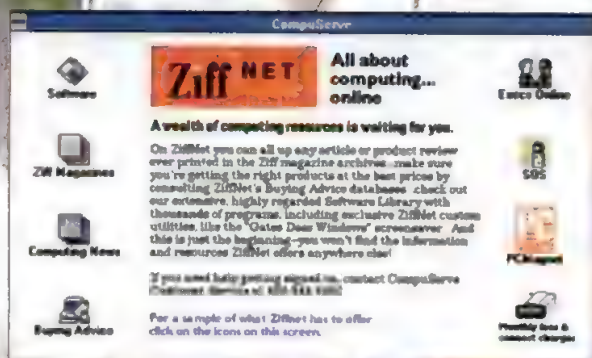
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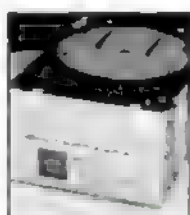
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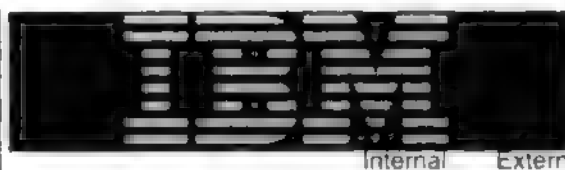
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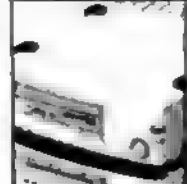
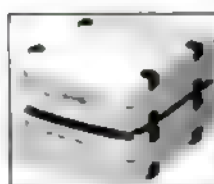
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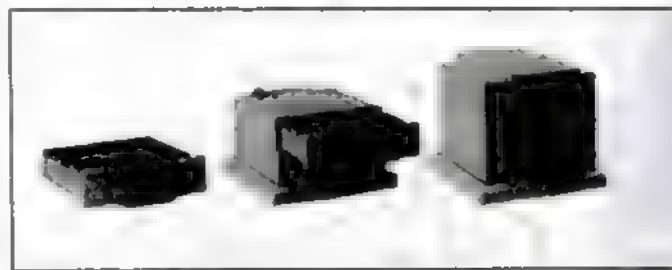


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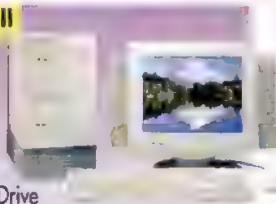


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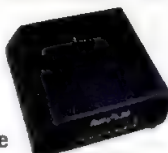
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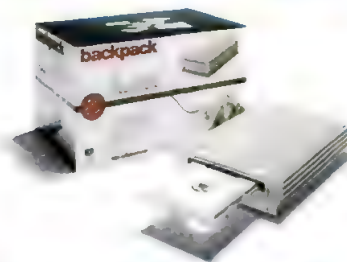
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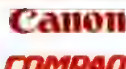


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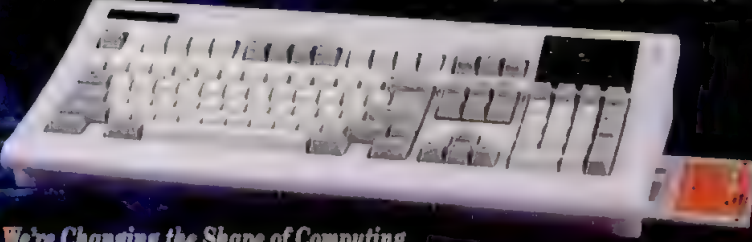
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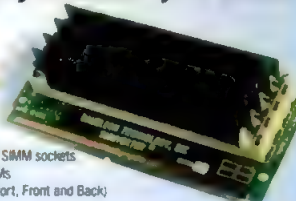
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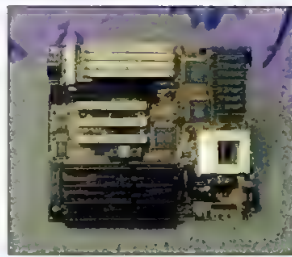
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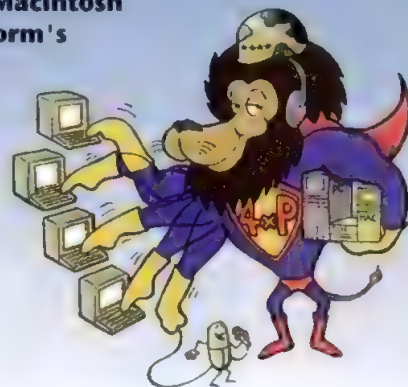
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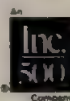
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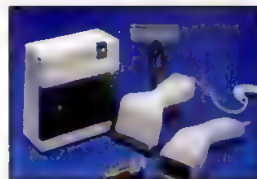


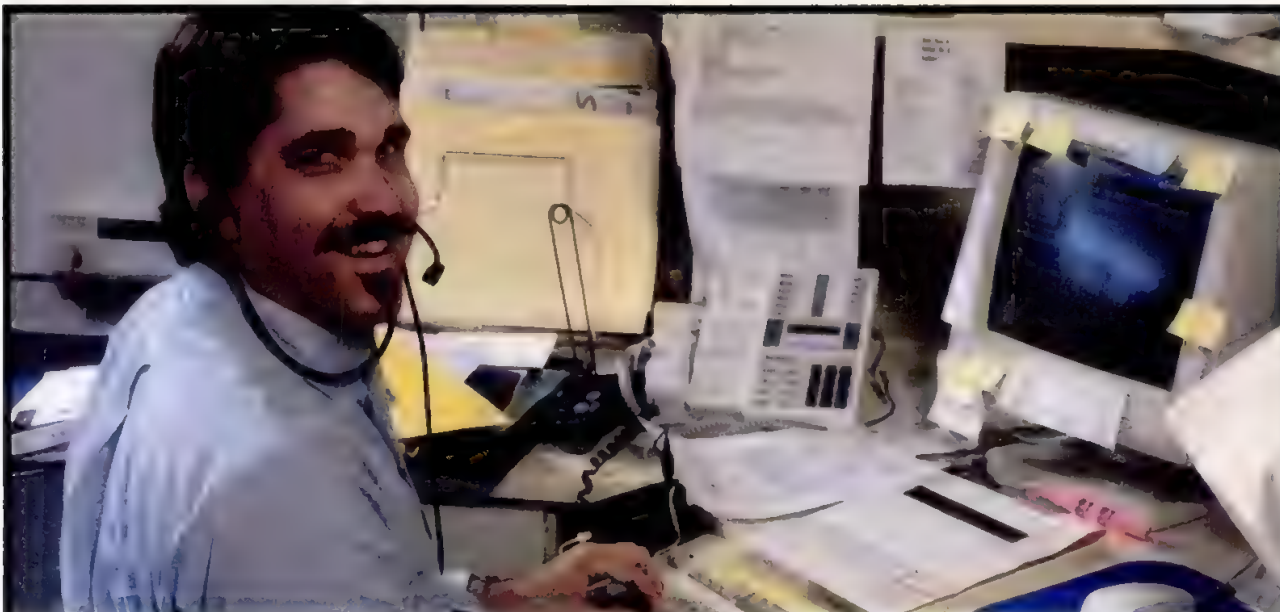
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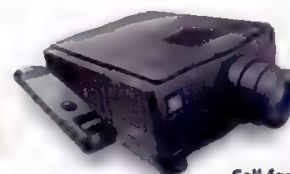
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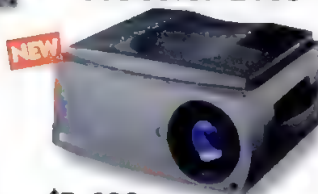
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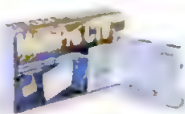
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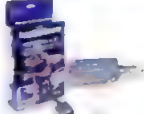
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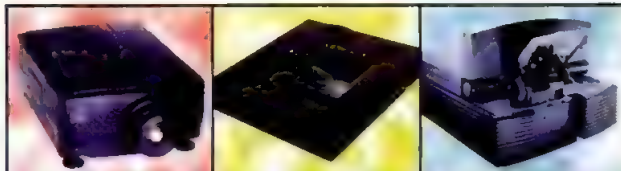
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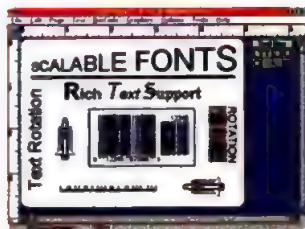
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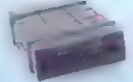
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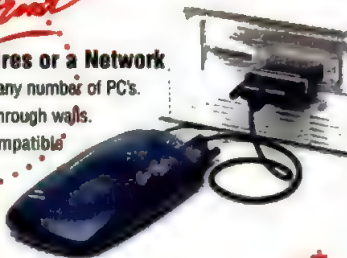
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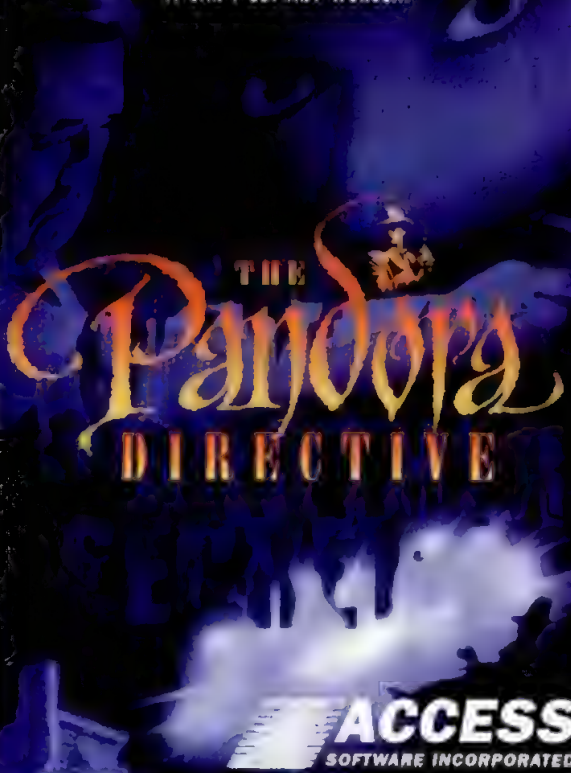
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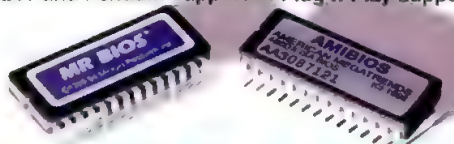
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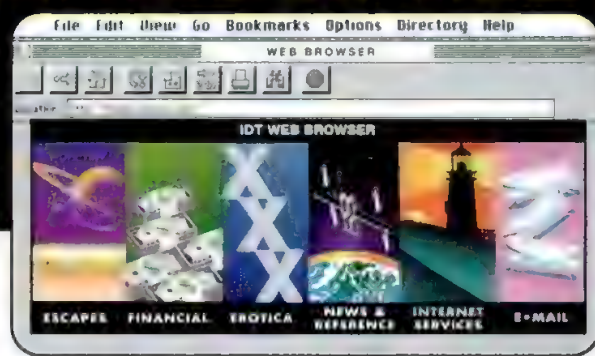
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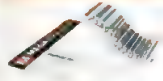
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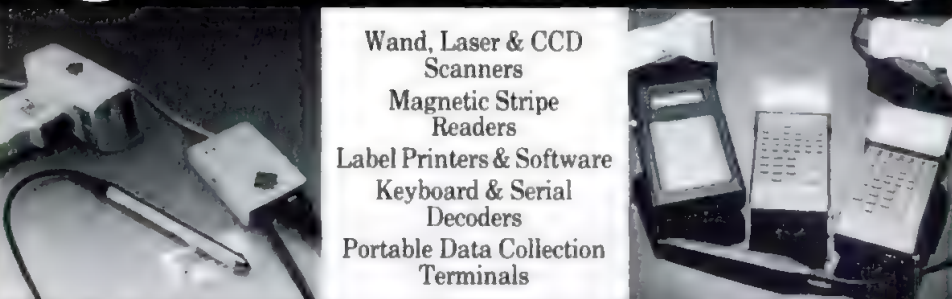
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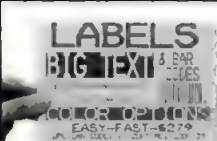
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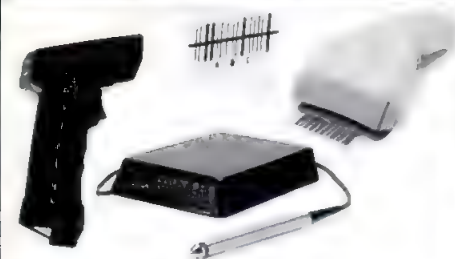
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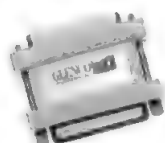
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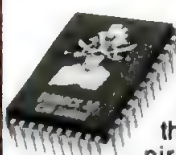
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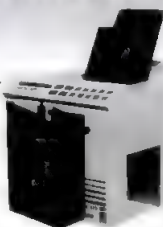
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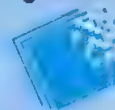
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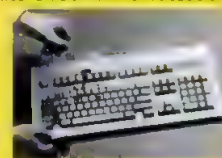
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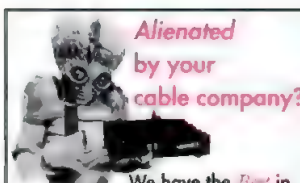
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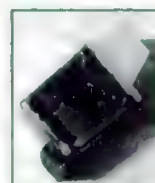
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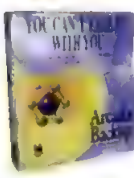
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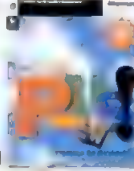
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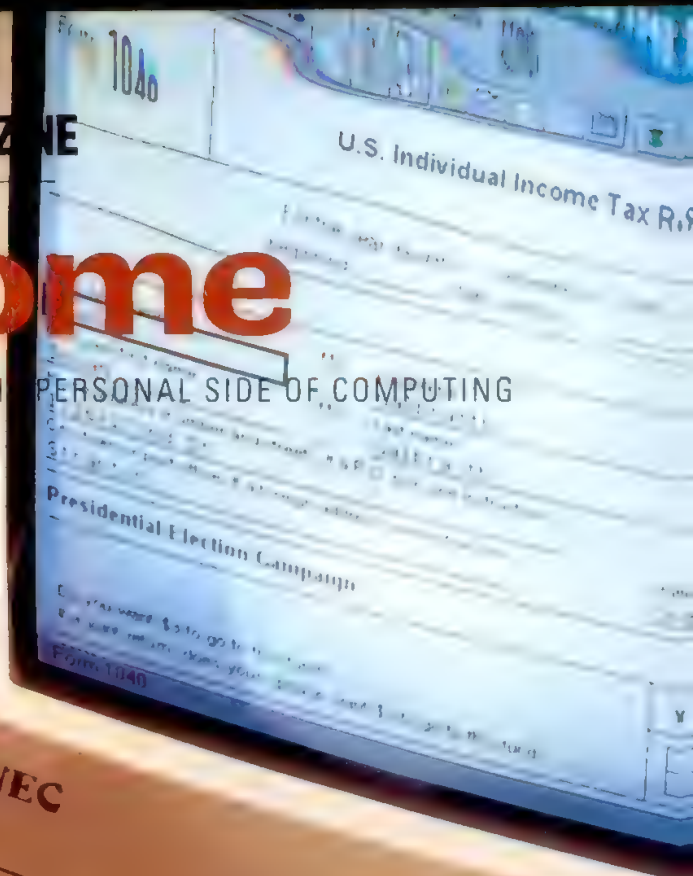
A SPECIAL REPORT ON PRODUCTS FOR THE PERSONAL SIDE OF COMPUTING

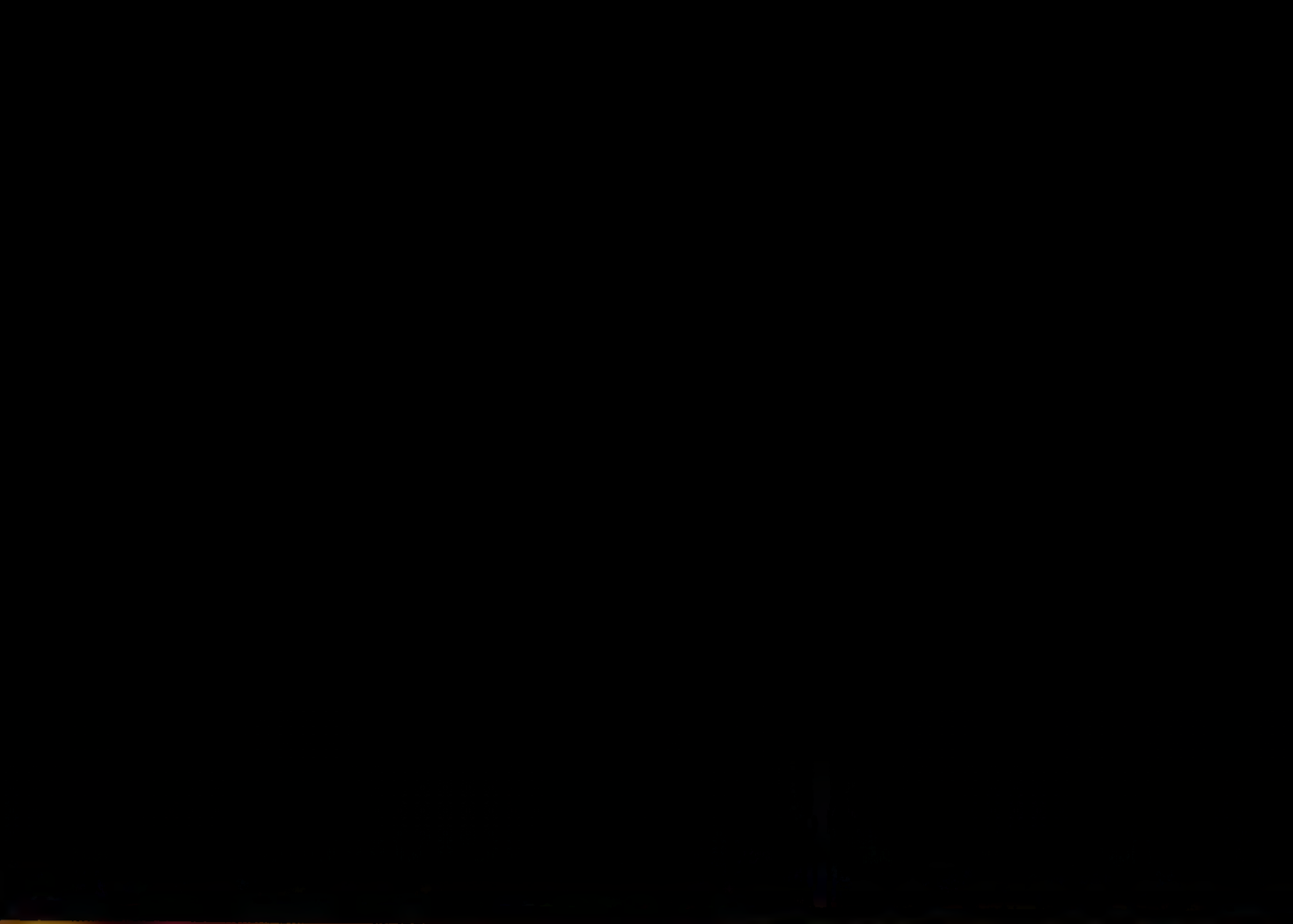
Taming The Tax Beast

By Kathy Yakal

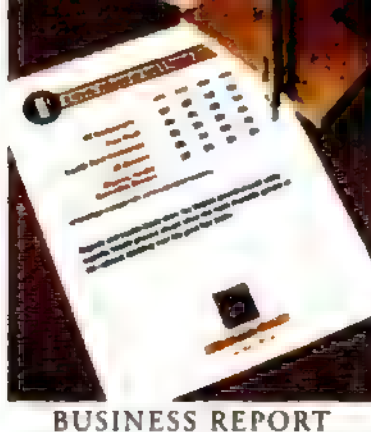
Yes, it's time once again to own up and tell the government how much money you've made, where you've spent it, and whether or not you owe them any more than they've already taken. You may have spent all year faithfully entering every transaction in a personal finance program, or maybe you barely managed to record all of your ATM withdrawals. Either way, tax preparation software can help you minimize the havoc wreaked by that beast we know as taxes.

A tax program's most basic benefit is simplified and consistent data entry. Type in your Social Security number once, and it's transferred to every other required line. No erasing. No transposition errors. That





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alone may be enough to prompt some people to use tax software, but there's more. Several kinds of guidance are available: text, video, and audio files that explain program procedures and tax law, and offer suggestions for ways to minimize your tax obligation legally. And step-by-step interviews will walk you through the entire 1040, posing questions and filling in forms based on your answers. When you're finished, you can review your entire return; the program points out any errors or omissions.

This year, we've reviewed

IN THIS REVIEW	
<i>Kiplinger TaxCut</i>	309
<i>Personal Tax Edge</i>	321
<i>Simply Tax</i>	322
<i>TurboTax Deluxe</i>	330
Editors' Choice	309
As Easy As...	314
Online Tax Info: Keeping Up with the IRS	316
DOS Tax Prep Products	324
Summary of Features	326
Tax Preparation for OS/2, Too	330

the four Windows-based tax packages available: Block Financial Corp.'s Kiplinger TaxCut, Parsons Technology's Personal Tax Edge, 4Home Productions' Simply Tax, and Intuit's TurboTax Deluxe. Each of these packages runs under Windows 3.1, although two of them—Simply Tax and Personal Tax Edge—also run as native Windows 95 applica-

tions. Other than Windows compatibility, the only other request we made of vendors was that they submit the most full-featured versions of their products. Lower-end, disk-based versions of both Kiplinger TaxCut (\$39.95) and TurboTax (\$39.95) are also available.

We also took a quick look at one OS/2 tax title ("Tax

Preparation for OS/2, Too") and a pair of DOS-only packages ("DOS Tax Prep Products: Still Kicking"). Finally, we took a spin around the World Wide Web and found an abundance of sites spilling over with tax resources and advice ("Online Tax Info: Keeping Up with the IRS").

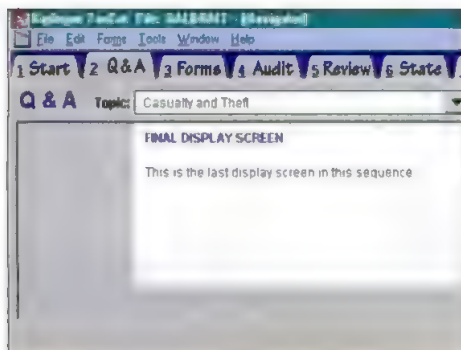
Because the IRS does not finalize its official forms and schedules until the end of each calendar year, filing versions of these tax software packages were not available for us to test in time to make this story (they usually ship in February, and this story went to press in late December). For this reason, we have—as always—reviewed the early planning versions of each package. They closely resemble the final versions, but quite a few changes are often made between the two releases. Because of these last-minute changes, bugs and problems not in the planning version sometimes appear in the final version. So be advised that the products we reviewed are not exactly the same as the software you'll use to file your taxes. You may want to check our Web site (<http://www.pcmag.com>) and each publisher's online support forum for any problems that may have cropped up.

A SHORT SEASON

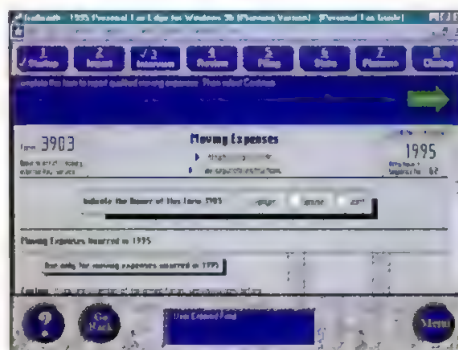
Tax software is used for only a very brief period each year. Consequently it must be so easy to use that it complies with the 2-second rule: If you have to consistently spend more than two seconds trying to figure out how to make your next move, the normally punishing process of tax preparation becomes unbearably grueling.

In recognition of this fact, tax software publishers have taken great pains to develop

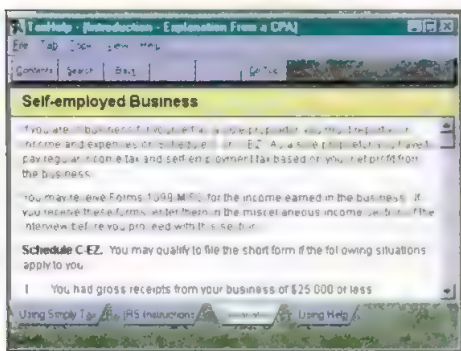
The Best & Worst of Tax Prep Packages



KIPLINGER TAXCUT's use of screen space is sleek and economical, but the program occasionally wastes entire screen displays to convey unnecessary messages.



PERSONAL TAX EDGE dumps users into unfriendly forms too often, rather than using a complete interview to shield users from the tedious task of manual data entry.



SIMPLY TAX's interface is much less confusing than last year's. Windows 95 conventions such as the tabbed help file (shown here), right-mouse-button help, and navigational icons helped minimize the chaos common in previous versions.



TURBOTAX's stylish look debuted last year, but it's even better this time around. File folder tabs and big icons make navigation the easiest in the group. Multimedia windows are sized appropriately and available if you need them but unobtrusive if you don't.

very friendly navigational and help systems. TurboTax Deluxe's EasyStep, for example, uses large, colorful icons to make your most frequently used commands readily available, while hiding less commonly used commands in menus.

The other major elements that distinguish the best tax programs are their guidance and feedback systems. Tax programs incorporate an enormous amount of help. Personal Tax Edge is a good example: Click on the help icon and a dialog box displays five different kinds of help, including verbatim IRS instructions and J. K. Lasser's tax guide. TurboTax Deluxe and Kiplinger TaxCut go one step further, offering multimedia video clips prepared by tax experts.

Each package here also does important cleanup work. For example, when you're finished entering data in Kiplinger TaxCut, it runs an audit that displays a list of data omissions and errors, and pinpoints entries that could trigger an audit. You can also use what-if worksheets to see the effect altering major entries on your 1040 might have on next year's taxes.

Filing options represent another crucial factor in any tax package. All of the programs reviewed here offer three filing options: printing IRS-accepted forms and schedules, transmitting your documents electronically (for an additional fee of less than \$15), and generating a 1040PC format form, an abbreviated version of the 1040, which the IRS accepts.

Individual state form add-ons are available for under

TurboTax Deluxe

Intuit's TurboTax Deluxe does not look all that much different than it did last year (when it also won our Editors' Choice award by edging out TaxCut). But it incorporates several enhancements and new features that—combined with the lack

of changes we found in the other tax preparation packages—distance it even further from its competitors.

This year, TurboTax Deluxe is the sole pick for our Editors' Choice.

While Intuit has continued to make improvements in Turbo Tax's fundamental tax processing capabilities, the real changes have come in how the program helps users easily understand the tax laws and determine what must be done to comply with them. TurboTax Deluxe accomplishes this daunting task through an interface that is as functional as it is attractive, right down to the control buttons surrounding the miniature video screen. A li-

brary of multimedia tax-related reference materials augments the already generous guidance that's available throughout the tax preparation process. Also, a multilevel audit/review feature provides users with

more confidence in the completeness of their returns and helps them prepare for a more palatable tax obligation next year.

Block Financial Corp.'s Kiplinger TaxCut, which captured an honorable mention last year, is still a solid, reliable product. But while Intuit made slight and subtle improvements to its product, Kiplinger TaxCut is pretty much the same as it was a year ago. This year, TurboTax Deluxe stands alone.



\$25 for each product reviewed here. These programs import data from your completed 1040 and transfer it to the appropriate place on the state forms. While much of the work is done automatically, you'll still have to supply some locality-specific information. State tax programs haven't always made it crystal clear what additional information is needed, but every vendor is implementing changes this year to rectify that.

State forms printing should also be less of a problem than it's been in the past, as every program reviewed here (according to company representatives) will print forms acceptable by every state they support for the 1995 tax year.

IS IT FOR YOU?

If you usually prepare your own tax return, there's no reason not to consider automating the process. If you're having it done professionally, you might consider trying your own hand at it and comparing your results to those of your tax professional.

But the basic benefits of today's crop of tax programs—automatic data duplication and behind-the-scenes calculations—combined with their vastly improved interfaces, cleanup and filing procedures, and guidance systems, give you more tools than ever to tame your own tax beast. Your completed tax return is less likely to have errors, and you're bound to discover deductions you might have otherwise missed. You'll also understand the whole process better and may be able to plan for a better bottom line next year.

Block Financial Corp.

Kiplinger TaxCut

ALL REVIEWS BY KATHY YAKAL

In the past, Block Financial Corp. and Kiplinger Washington Editors each produced a version of TaxCut. This year, they have joined forces to produce one version: Kiplinger TaxCut (\$39.95). Users of previous versions won't find many startling changes this year. In fact, both those users and new ones will find the same things that the product has always offered (in all its incarnations): a sturdy, reliable vehicle for personal tax preparation. While TaxCut has not yet caught up with TurboTax—which TaxCut had surpassed two years ago—the product remains worthy of recommendation.

Understandable and accurate interpretations of tax law are one of the most critical el-

Our Contributors: KATHY YAKAL is a frequent contributor to *PC Magazine*. SARAH L. ROBERTS is a staff editor of *PC Magazine* and MICHAEL E. RYAN was the associate editor in charge of this story.

ements of personal tax preparation software, and TaxCut again does a good job of providing them. The most notable enhancement in this year's version, the addition of Kiplinger's Tax Tips, improves on the product's already solid guidance features. You can view simple explanations and helpful examples in the context of a given task by clicking the Tax Tips icon or by searching the package's entire library. The Tax Tips text files—like the video clips sprinkled throughout the program—are for the most part lively, well written, and informative.

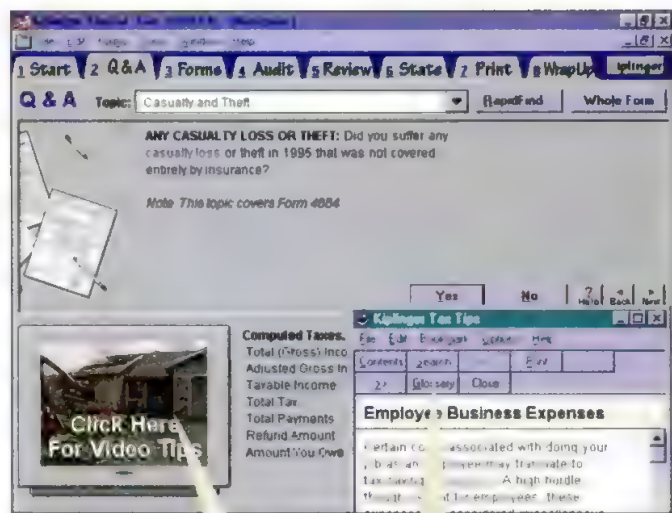
TaxCut's Q&A, a question-and-answer method of entering data, works much the same way as it has in previous versions. Questions appear at the top of the screen, and the

lower portion of the screen alternates between the current form and a running tally of your taxes. Click on the Whole Form icon and the form you're currently working on opens up full-screen; another click and you're back to where you were.

You can navigate through the Q&A section with forward and reverse buttons, but we found the latter to be a bit quirky. The forward arrow walks you sequentially through the entire set of questions, but the reverse arrow is inconsistent: At times, it takes you to the previous screen, and at others, it pops you out to the topics list.

Overall, though, TaxCut is intuitive and well organized, keeping confusion to a minimum. File folder tabs running across the top of the interface divide the program into its

REPORT CARD	
Kiplinger Tax Cut	
Preparation	A
Guidance	A
Audit/review	B



Kiplinger TaxCut offers users plenty of guidance in the form of both text files and video clips.

core sections and are used for navigation. If you're using the Q&A feature, you can click on the Forms tab to bring up a list of forms and to go to a particular document. You can also move to the Shoebox from the Q&A screen to find the cor-

rect form for miscellaneous canceled checks and receipts. The RapidFind feature displays a detailed list of topics and issues relating to tax, and it takes you to the appropriate section for data entry.

TaxCut's program and tax help is abundant. The roving *i* information icon from last year is back, and it consolidates the program's myriad guidance aids effectively. In both Q&A and direct data entry, you click this icon on forms and schedules and a dialog box opens displaying help options. You can look at Kiplinger Tax Tips, an explanation of the document you're working on, IRS instructions for completing forms and worksheets, and a list of related items. You can also mark an entry as tentative, document it, and override its write protection.

The *i* icon is not active on every Q&A screen, but clicking on hypertext links within a question brings up a focused explanation of the rules and requirements behind that particular point of tax law. This is often the most useful, immediate guidance available since

REPORT CARDS

Reading the Report Card

A tax preparation package can significantly minimize the headaches involved with doing your taxes by guiding you through the entire process and generating your actual returns. Along the way, you may even learn a thing or two that will help save you some money. We graded each of the four Windows-based tax prep packages in three important categories. The grades we used and their meanings are as follows: *A*, excellent; *B*, above average; *C*, average; *D*, below average; *E*, failing.

We looked carefully at the product's basic tax preparation capabilities. An average rating indicates that the product included an adequate number of forms and schedules, and automatically linked data fields between them. An above average rating was given if the program imported .TXF files from personal finance applications and offered three data entry options: an interview, a shoebox/organizer feature, and basic forms-based data entry. Top marks were given

to programs that offered all of the above features, and then went the extra step to keep everything simple and user-friendly.

Guidance through the tax preparation process is also vital. A high score here indicates that information on tax law is available—if not abundant—and easily understood. The best programs will also offer tax tips to help you save money and incorporate multimedia clips and text files that actually help illustrate a point, rather than demonstrate your PC's ability to play .AVI files.

To determine a grade for **audit/review**, we evaluated the ways in which each product allows you to build "what if" scenarios, which show how your taxes might change as your financial situation changes. High scores in this category indicate that the package also lets you compare the results of filing your return separately to the effect of filing it jointly with your spouse. Lastly, top-rated programs will offer ways to audit and review your completed return, checking for any errors or omissions, pointing out missed deductions, and offering advice for the next tax year.

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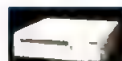


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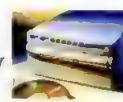
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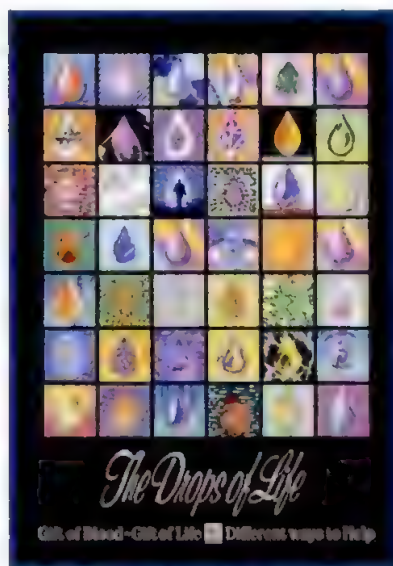
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As Easy As...

Here you see three steps that we went through during each product's interview process to enter deductions for charitable contributions.

Kiplinger Tax Cut

CHARITABLE CONTRIBUTIONS: Did you make any (deductible) contributions during 1995?

Notes: If you're not sure whether the recipient qualified, then select "No" and find out.

Yes No

Explain 1 for Tip

Charity gifts (Schedule A, lines 16 and 18)

Kiplinger TaxCut offers welcome advice throughout Tax Tips, as this explanation of the charitable contributions rules illustrates.

TaxCut

CASH CONTRIBUTIONS: Please enter the TOTAL amount of your deductible CASH DONATIONS, if any, in 1995 by cash, 1995, or 1994 or 1993.

Your Response: 1000

MINI-WORKSHEET FOR LINES 16 AND 18, CHARITABLE CONTRIBUTIONS, DEDUCTIONS

1. CASH CONTRIBUTIONS

As you enter data in the upper portion of the screen in response to queries, the corresponding form appears below.

TaxCut

MINI-WORKSHEET FOR LINES 16 AND 18, CHARITABLE CONTRIBUTIONS, DEDUCTIONS

1. CASH CONTRIBUTIONS

2. NON-CASH CONTRIBUTIONS

3. TOTAL

TaxCut provides helpful mini-worksheets for calculating totals before the numbers get filled in on the actual form.

Personal Tax Edge

Did you or your spouse contribute cash or property to charitable organizations?

Yes No

Go Back Interview

Personal Tax Edge's Interview walks you through the filing process in clear, easily understood steps.

Personal Tax Edge

Schedule B - Charitable Contributions 1040

Line 15 - Contributions by Cash or O

1. Cash or check contributions

2. Contributions from Schedule E-1

3. Automobile Expenses

Watch the on-screen instructions carefully, as you will often have to fill out only one line instead of the entire form.

Personal Tax Edge

Schedule B - Charitable Contributions 1040

Line 15 - Contributions by Cash or O

1. Cash or check contributions

2. Contributions from Schedule E-1

3. Automobile Expenses

After you answer all of the questions, the information you entered appears in the correct spots on the 1040.

Simply Tax

Please select the type of itemized deduction you wish to work on.

If you would like to go through the entire itemized deduction section of the interview, press All. If you are finished, press Next.

Medical Expenses

Taxes Paid

Interest Paid

Charity

Casualty/Theft

Job Expenses

Misc. Deduction

All

With Simply Tax's TaxWizard, you can choose to go through all of the included questions, or only selected ones.

Simply Tax

Please enter the amount of charitable contributions that you made by cash or check during 1995.

1000

This rather underused screen is, if nothing else, easy to understand. Just fill in the amount and proceed.

TurboTax Deluxe

Gifts to Charities

Did you give any cash gifts to churches or other charities?

Yes No

Gifts to Charities Worksheet

TaxWizard incorporates any form you require into its interview, then transfers your information to Schedule A.

TurboTax Deluxe

Cash Contributions

These are the last two where we wrote in the names of common charities on our statement. After that, you will enter your own descriptions if you have more charities to list.

Cancer Fund: 500.00

Heart Fund: 500

TurboTax Deluxe breaks out the charitable contributions deduction into the most commonly used organizations.

TurboTax Deluxe

Gifts to Charities

Did you give any cash gifts to churches or other charities?

Yes No

Gifts to Charities Worksheet

You can add your own, too, making for a simple, well-integrated way to document the numbers behind your final figures.

TurboTax Deluxe

Gifts to Charities

Did you give any cash gifts to churches or other charities?

Yes No

Gifts to Charities Worksheet

Without cluttering your path with extraneous screens, TurboTax Deluxe transfers your raw numbers to the completed 1040.

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the forms' explanations are frequently quite broad, and Tax Tips doesn't always apply to the current screen.

TaxCut's wrap-up and summary functions are especially thorough. You can run an audit, which looks for missing or erroneous data and suspicious numbers. The Review feature is a four-part information display divided into sec-

tions by file folder tabs. You can view a bar graph of your bottom line, a list of the most critical figures in your return, and a pie chart that compares your share of your money to the IRS's take. While these visuals can be interesting, the most useful element of this section is the screen that displays all lines where data was entered and lets you move to the

corresponding forms and back.

Kiplinger TaxCut hasn't made any quantum leaps forward this year, but its closest competitor, TurboTax, has. TaxCut's interface lacks TurboTax's elegance. Also, TaxCut doesn't offer the extra reference materials, well-blended guidance, and complete audit features that TurboTax does. But TaxCut's healthy combina-

tion of easy navigation, sound advice, and processing tools for many financial situations makes for a usable, respectable tax preparation package.

Kiplinger TaxCut. List price: \$39.95. Block Financial Corp., Kansas City, MO; 800-235-0229, 816-751-6000; fax, 800-561-0673; <http://www.conductor1.com>. Circle 441 on reader service card.

Online Tax Info: Keeping Up with the IRS

By Sarah L. Roberts

Who can think of taxes without a twinge of fear, accompanied by dark visions of menacing IRS employees, the looming April 15 deadline, and nasty audits? But this year can be different. You can avert some tax-induced anxiety by acquainting yourself with the tax-related resources on (what else?) the Internet. Both the number and the quality of resources on the World Wide Web may surprise you. Here's a look at just a few of the useful sites we found.

For many of us, the IRS is at the root of the aforementioned fear of taxes. Your feelings may change, however, after you visit the IRS home page (<http://www.ustreas.gov/treasury/bureaus/irs/irs.html>). This site—easily the most impressive of the ones we visited—offers extensive lists of tax forms, IRS publications, and tax tables. You'll also find detailed instructions on many filing procedures. It also features the ability to search the forms by keywords. Finally, there are explicit instructions for obtaining tax forms and filing your return electronically.

The Income Tax Information in Internet Page (<http://www2.best.com/~ftmexpat/html/taxsites.html>) is another extremely valuable site, primarily because it offers many links to other pertinent sites. The page includes lists of tax-related Usenet newsgroups, articles from various newspapers and journals on all aspects of taxation, and explanations of new and proposed changes to U.S. income tax law. This site also contains links to both state and federal tax forms.

For tax information and advice from the book *J.K. Lasser's Your Income Tax 1995*, take a look at the eponymous home page (<http://www.mcp.com/bookstore/jklasser/jklhome.html>). Text from the book is posted, and covered topics include what to do if you

have dependent children, own a home, make investments, have rental property, and so on.

Ernst and Young, the prominent accounting firm, also has a substantial Web presence (<http://www.ey.com/us/tax>). Our Favorite part of this site is the "Twenty-Five Most Common Tax Preparation Errors" page. The 1996 Tax Calendar is quite useful as well.

Many of the tax-related sites take a folksy approach. The Tax Prophet home page (<http://www.taxprophet.com/tp.html>), for example, is filled with zany graphics. But don't let the crazy pictures fool you; this creation of Robert L. Sommers, a San Francisco tax attorney, is jammed with useful newspaper and journal articles, international tax law information, and more.

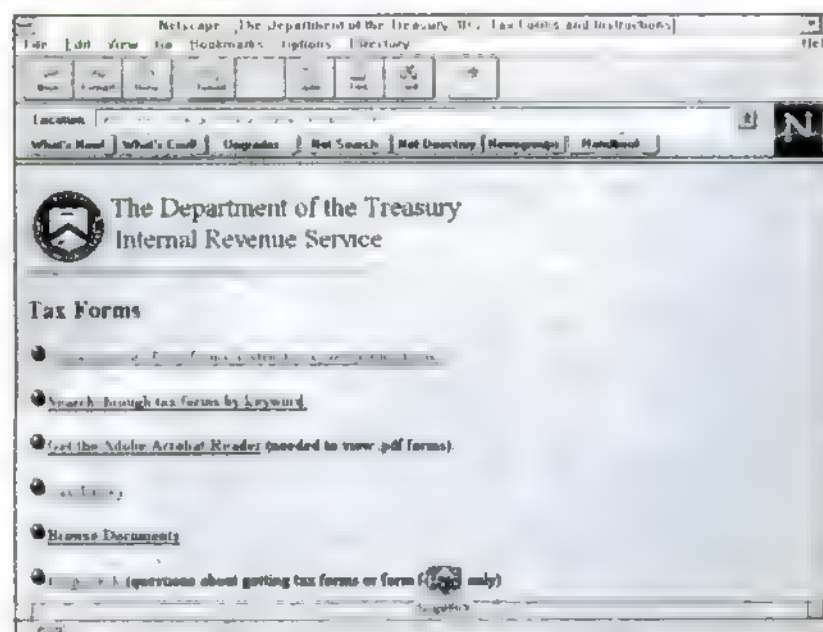
Taxing Times 1995 (<http://www.scubed.com/tax/index.html>) is another light-hearted but information-rich tax site. This consumer-oriented source includes federal and state tax forms, and it promises even more information as the April deadline creeps closer.

In addition to these advice-giving pages, another group of sites consists purely of tax news and history. Tax World (<http://omer.cba.neu.edu/home>), for example, which is maintained by Associate Professor Thomas Omer of Northeastern University, contains many articles on tax

policy, the history of taxation, a guide to the language of taxation, and more.

You can find the text from the last 13 issues of Tax Digest on its page (<http://www.unf.edu/misc/jmayer/taxdig.html>). Articles here cover a variety of topics ranging from electronic filing to tax audit activity.

Lastly, for the most up-to-date information on tax activity and law, load up the Tax Notes News-Wire (<http://205.177.50.2/news.htm>). This site is updated three times a day.



The World Wide Web contains a wealth of tax-related sites, most of which are loaded with useful advice.

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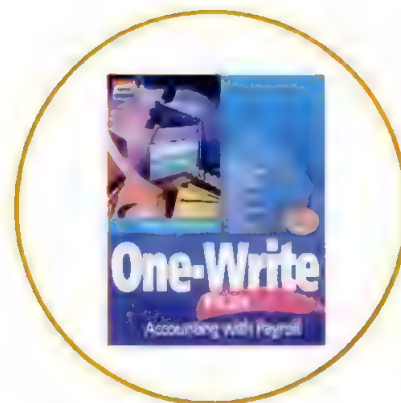
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Experts agree: Windows 95 demands APC protection



If you're using a computer, few things are more certain than power problems. If you haven't yet had a blackout, lost a hard drive, or toasted a modem, you will. It's almost a statistical certainty.

No surprise that PCWeek showed power problems such as blackouts, brownouts, and surges accounted for almost as much data loss as all other factors combined, or that a leading accounting firm attributed the largest single cause of computer downtime to—you guessed it—bad power.

MULTI-TASKING MULTIPLIES YOUR RISK OF "THE BIG ONE"

Multi-tasking operating systems like Windows 95 let you open and manipulate multiple files and applications at the same time. That's why, unfortunately, as PC Magazine says "When Windows 95 does crash, it's a horrible mess..."

Moreover, if you are "wired" to the Internet, an on-line service, or dialing into the office, you'll discover that phone lines are common paths for surges taking the express route direct to your motherboard.



In short, if you still don't have proper protection (that \$5 surge strip doesn't count) it's time to protect yourself before you kick yourself. Experts agree: If you choose not to decide on proper protection now, the next time you see this ad may be too late.

ROI IN THE BLINK OF AN EYE

More than 4,000,000 smart computer users protect against the inevitable with the affordable: award-winning power protection from APC, including the UPS that's winning praise the world over: the Plug n Play Back-UPS Pro. Ask them and they'll tell you: One prevented problem is all it takes to pay for proper power protection many times over.

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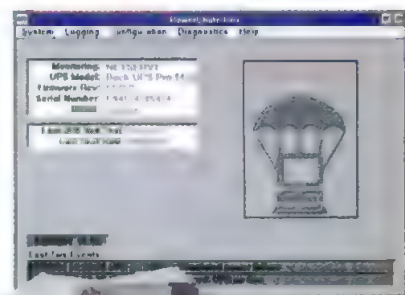
CLOCKWISE: "I'm an electrical engineer, and understand what's needed to protect a Pentium-class machine. I recommend these to everyone I know," says Jim Rawmick. "I especially like the Back-UPS Pro because it compensates for voltage irregularity without kicking over to battery."

"We've had great experience with APC," says Gordon Zellers. "The Back-UPS Pro has great features: it tells you if the battery is getting low, and they're user-replaceable with no hassle. As a small business, our computers and phones are vital to us. So is APC protection."

"As a Fortune 500 company, we've used APC for at least 6 years," says Matt Lazar of Phelps-Dodge subsidiary Columbian Chemicals Co. "The new Back-UPS Pro PnP is easier to use than ever and is now our preferred UPS for our corporate PCs."

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Back-UPS Pro			
Volt-Amp Rating	List Price	Runtime*	
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420PNP (Includes software)	\$339	8 min	
650PNP (Includes software)	\$419	17 min	
1000 (software not included)	\$589	35 min	
1400 (software not included)	\$759	74 min	

*Runtime shown is for typical Pentium desktop system and may vary with your actual load. Note: Back-UPS 200 not recommended for Pentium systems.

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400 (software not included)	\$199	24 min	
450 (software not included)	\$254	31 min	
600 (software not included)	\$359	47 min	
900 (software not included)	\$529	75 min	
1250 (software not included)	\$689		

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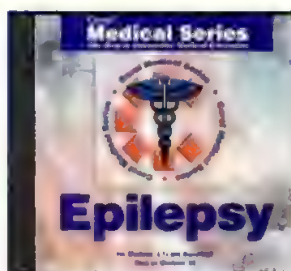
Upcoming Titles:

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- Asthma & Chronic Obstructive Lung Diseases
- Alzheimer's & Related Dementias
- Breast Feeding
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- Headaches
- Arthritis
- Sleep Disorders
- Canadian Medical Association Medical Publications
- Pediatric Cardiac Anomalies
- Pediatric Renal Anomalies

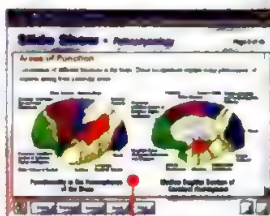
Body Systems

- Special Senses
- Neurology
- Immune System
- Gastrointestinal Tract
- Mind
- Reproductive System
- Renal System
- Respiratory System
- Endocrine System
- Musculoskeletal System
- Hematology System



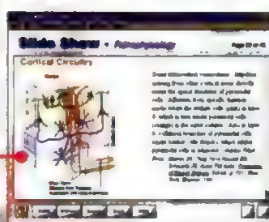
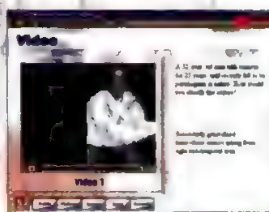
\$24.95*
S.R.P.*

Written by a neurologist with a special interest in the field of epilepsy:
A. Guberman M.D., F.R.C.P. (C)
Professor of Neurology, University of Ottawa

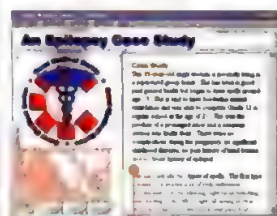


Slide Show
Includes a search feature, allowing self-navigation through all text and images.

The first title in the Corel Medical Series covers the topic of epilepsy from various perspectives, including pathophysiology, epidemiology, diagnosis and treatment, in a comprehensive, problem-based interactive format. This multimedia title provides a wealth of up-to-date information on this rapidly expanding area of medical research and offers in-depth analysis of all aspects of epilepsy. This indispensable CD-ROM is an invaluable resource for medical students, physicians, neurology and psychiatry residents, nurses and especially patients and their families.



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Parsons Technology

Personal Tax Edge

When we review Personal Tax Edge (PTE), we typically find that it runs a close third behind TurboTax and TaxCut. And while this year PTE boasts a few advantages over its competitors, it still has a way to go before matching them, especially TurboTax.

PTE stands apart from the other tax packages for two reasons: First, it's the only product available in two separate native versions for both Windows 3.1 and Windows 95 this tax year (unlike Simply Tax, which requires Win32s for Windows 3.1 use); and, as it has been in most years, PTE, at \$19, is the least expensive package in our roundup. Like the others, how-

All things considered, PTE is a solid package and the best choice for users who either have to have a native Windows 95 application or are on a strict software budget.

One of PTE's 1995 additions becomes evident right away, as you fill out the basic information worksheet using the Tax Guide. If you fail to enter critical information, you immediately see a message alerting you to the omission. This occurs in other parts of the program too. Normally, this kind of warning doesn't pop up until you're running a final audit or review of your return, so the early notice is a welcome addition.

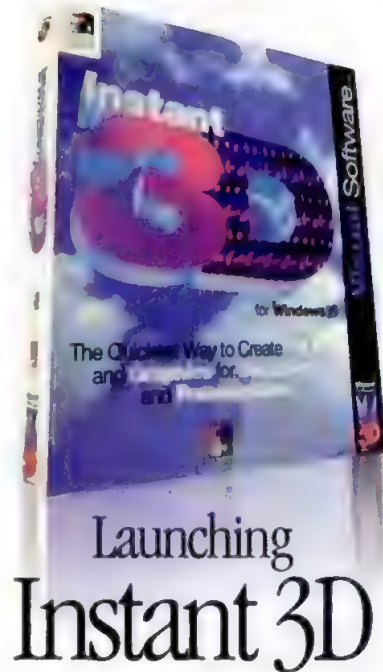
The Tax Guide functions much like the interview option in other programs, with one significant exception: It walks you sequentially through your re-

Rather than leaving all the cleanup work for last, Personal Tax Edge nabs errors and omissions along the way.

ever, PTE offers only a handful of features that were not in previous versions. The most notable enhancements include additional immediate feedback throughout the package's interview segment (Tax Guide) and a less confusing data entry process. PTE also includes more forms this time around.

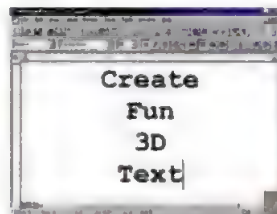
turn, asking questions and diverting you to the appropriate areas based on your answers. You have to enter the lion's share of data directly onto the IRS forms and schedules yourself. But one of PTE's helpful features prevents you from entering more data than was asked for, which was easy to do

Blast Off!



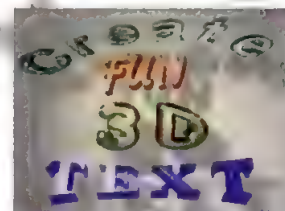
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AT HOME
Tax Software

in previous versions, especially if you didn't watch on-screen directions carefully. This year PTE locks you out of every line but the one (or ones) required, so you can't go too far too soon. It's a very helpful alteration, but we'd still like to see the Tax Guide function completely outside the forms and schedules. That way, users would see more of a distinction between the interview process and direct data entry.

When you're entering tax data on the forms themselves, navigation is menu-driven. Noicons are available for frequently used functions, though the right-click help convention is well implemented. You work from a tabbed box that holds two central lists: Tax Documents Received, and Forms and Schedules. Color-coded zeroes on each blank form indicate whether the field is open for data entry or calculated by the program. Fields that are automatically calculated are locked; they cannot be changed unless you use the Override command.

Unlike the forms and schedules, the Tax Guide uses icons for navigation and help, and to bring up the kind of local menu that right-click help normally does in Windows 95. (Right-click help does not work on the Tax Guide question-and-answer screens.) A scrolling list of interview topics remains on-screen, and icons appear on the list next to recommended or completed topics and those that have been imported.

It's simple to move back and forth between forms and the Tax Guide. And it's much easier to navigate within the Tax Guide than it was in previous

versions. This is due to the new version's more closely controlled data entry, and the big, colorful icons at the top of the screen (and other hard-to-miss navigational objects): They divide the program into individual working segments.

Parsons Technology has always incorporated a good help system into its tax product, and this year's version is no exception. At every step of the

way, you can access several kinds of help: context-sensitive tax tips, IRS instructions, program help, answers to common questions, and J. K. Lasser's tax guide.

Additional help is available after you've completed your first pass through the return. You can run an audit report to see a list of all incomplete or suspicious fields, or you can request an interactive audit. We definitely recommend the latter: It highlights fields that may need changing and gives you the opportunity to change them.

For the 1995 tax year, PTE remains what it's been for so many years: a reliable, inexpensive, and relatively user-friendly tax guide.

Personal Tax Edge. List price: \$19. Parsons Technology Inc., Hiawatha, IA; 800-223-6925, 319-395-9626; fax, 319-395-7449; <http://www.parsonstech.com>. Circle 442 on reader service card.

4Home Productions

Simply Tax

4 Home Productions' Simply Tax (\$19.95) has come a long way since last year. Some of the confusion created by a much-too-busy interface has been eliminated, and Sim-

REPORT CARD	
Personal Tax Edge	
Preparation	B
Guidance	B
Audit/review	B

DMD 21 2:35
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CIRCLE 101 ON READER SERVICE CARD

DOS Tax Prep Products: Still Kicking

By Kathy Yakal

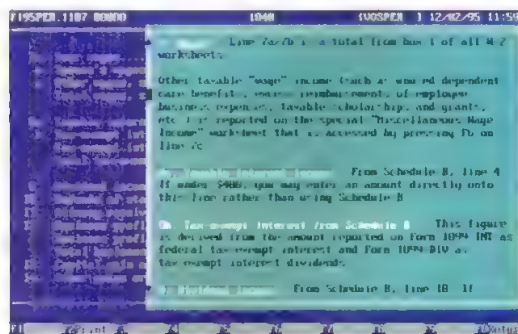
Although we did not include DOS-based tax packages in our review this year, there was some activity in the DOS-only tax preparation market. Both Intuit and Parsons Technology released DOS versions of their respective packages for 1995, while Block Financial Corp. announced that it was no longer updating its DOS product. (4Home, on the other hand, never offered a DOS version of Simply Tax.) For the most part, the DOS versions of these packages are very similar to their Windows counterparts, just without the helpful graphic user interfaces (GUIs) and the multimedia bells and whistles.

We did take a look at two other DOS products this year. AM-Tax (\$39, AM Software, 800-859-8537) has returned, and so has TaxPerfect—but with a new name and price: Perfect Tax (\$39.95, Financial Services Marketing Corp., 800-525-5611).

AM-Tax remains one of the most consistent, reliable titles in this field. There's no interview option and guidance is minimal, but if you want a clean, credible framework for entering your tax data in a DOS environment—and know your way around IRS documents—AM-Tax is for you.

While last year's version could run right off a floppy disk drive, this year's AM-Tax requires 1.5MB of hard disk space. The extra space holds several improvements though.

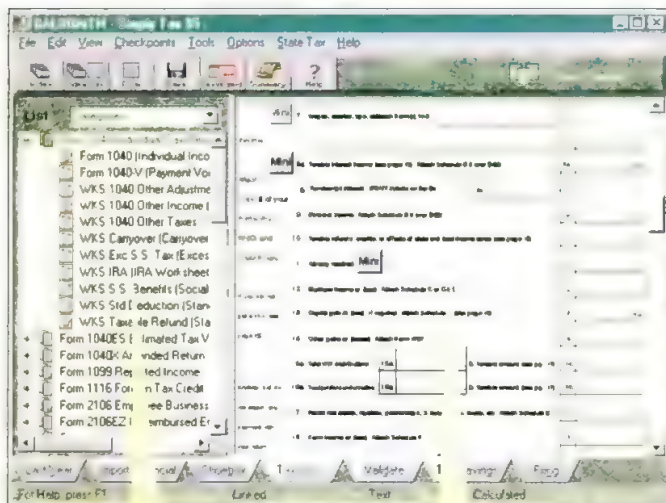
You can now print near-laser-quality forms on dot matrix and inkjet printers, without installing extra software or fonts. New worksheets help you calculate and document entries, such as automobile expenses, net operating losses, taxable pension proceeds, and others. Form 1040V and Schedule H (Household Employee Taxes) have also been added. Pick lists help you enter data quickly into many fields. Warning and error messages provide more information and, as always, IRS instructions are available. Finally, AM-Tax includes a total of 74 forms, schedules, and worksheets.



AM-Tax doesn't have a flashy interface, but it remains a reliable tax prep package.

Perfect Tax costs as much as the most expensive product in this story but offers only a fraction of the guidance and navigational aids found in TurboTax Deluxe and the other products. Like AM-Tax, Perfect Tax provides on-screen representations of 95 IRS forms, schedules, and worksheets where you enter information directly. In addition to function keys, Perfect Tax uses drop-down menus for file operations and navigation, and IRS instructions are included.

Perfect Tax also offers a helpful graphical map of IRS forms and schedules, so you can see at a glance which data feeds into an individual document. The Tax Summary gives you a running tally at any time of your current tax liability and does an automatic comb-through of your return to pinpoint errors and omissions.



Simply Tax uses a Windows 95 Explorer-like interface that lets you pick forms from a list and preview them at the same time.

Simply Tax is the only product that is expected to be released specifically for Windows 95 in its final version. It also operates under Windows 3.1 using Win32s (as opposed to Personal Tax Edge, which is available as two separate versions).

In some ways, Simply Tax is as robust as this year's best. It serves up a generous plateful of forms and schedules, and supplies the navigational and help tools needed to complete the right ones in the right way. But Simply Tax's interface still has some uneven patches that get in the way of a smooth, uninterrupted journey through tax preparation.

Not that there aren't some

improvements to the interface: Gone is last year's jumble of on-screen windows. In its place is a more cohesive, streamlined interview process (the Tax Wizard) that more closely rivals the other tax packages'. Icons running beneath the question-and-answer box let you move forward, backward, and to specific individual forms. They also open the Tax Wizard topics list and access help. On every interview screen where the process of creating a form or schedule begins, you'll find icons that allow you to add, change, or delete a copy. Rather than click on Yes and No icons to respond to the interview's queries, you uncheck a box if the current



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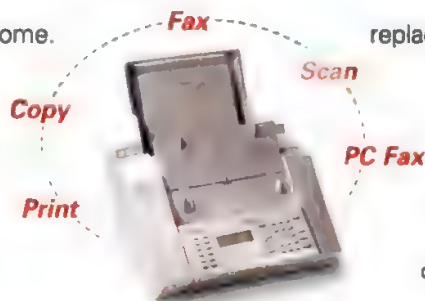
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SUMMARY OF FEATURES

Personal Tax Preparation

PC MAGAZINE
EDITORS' CHOICE

■ YES ■ NO

Products listed in alphabetical order

	Kiplinger TaxCut	Personal Tax Edge	Simply Tax	TurboTax Deluxe
General Features				
List price	\$39.95	\$19.00	\$19.95	\$49.95
Windows 3.1 version	■	■	■ (Win32s)	■
Windows 95 native/compatible	■ ■	■ ■	■ ■	■ ■
Professional version available	■	■	■	■
Software Features				
Context-sensitive help	■	■	■	■
Interview option	■	■	■	■
Shoebbox organizer option	■	■	■	■
"What if" analysis	■	■	■	■
File-import formats supported	.TXF	ASCII, .TXF	ASCII, .PRN, .TXF	.TXF
Uninstall feature	■	■	■	■
Tax Help				
Provides online IRS instructions	■	■	■	■
Interprets IRS instructions	■	■	■	■
Provides online tax-saving tips	■	■	■	■
Provides tax planning for 1996	■	■	■	■
Includes miniworksheets	■	■	■	■
Offers expert advice	■	■	■	■
Compares return with national averages	■	■	■	■
Looks for errors and omissions	■	■	■	■
Flags possible IRS audit situations	■	■	■	■
Checks for unclaimed deductions during review	■	■	■	■
Forms Preparation				
Number of forms, schedules, and worksheets	100	80	120	More than 100
State versions available	AZ, CA, CO, CT, DC, FL, GA, IL, IN, MA, MD, MI, MN, MO, MS, NC, NJ, NY, OH, OR, PA, TN, VA, WI	DC and all states except AK, FL, NV, SD, TN, TX, WA, WY	AZ, CA, CO, CT, FL, GA, IL, IN, MA, MD, MI, MN, NJ, NY, OH, OK, PA, UT, VA, WI	DC and all states except AK, NV, TX, SD, WA
Cost per state version	\$24.95	\$19.00	\$17.95	\$24.95
Filing				
Prints IRS replica forms on laser and dot matrix printers	■	■	■	■
Supports electronic filing	■	■	■	■
Electronic filing fee	\$9.95	\$15.00	\$14.95	\$14.95
Supports filing in 1040PC format	■	■	■	■
Technical Support				
Support via phone/fax	■ ■	■ ■	■ ■	■ ■
Online forum	■	■	■	■
Extended hours during tax-filing season	■	■	■	■

topic does not apply to you, and fill in blanks and check boxes when it does. You can switch to a topic's form and back easily, and moving to any other major element of Simply Tax is as simple as clicking its file folder tab. Menu items duplicate these functions and facilitate others.

That said, Simply Tax is not as effective as it might be: Its

new interface is still unnecessarily busy, and performance is not top-notch. Screen redraws are slower than other

Windows 95 software we've seen running on a 486DX2-66. If you enable the automatic recovery feature so your data is saved every x minutes, you'll have about a 7-second timeout during each save. The photographs that accompany in-

terview screens don't really add anything to the process, so the space might be better used for larger typefaces and bigger icons, or some useful, related illustrations or text. And while revisiting a topic in the Tax Wizard after you've gone through it once is easy, you can't go through the entire return sequentially again.

While entering data directly on the forms, you can select individual forms and schedules from Simply Tax's master list,

or find your way to the right line by selecting a tax topic from the Shoebbox. In both cases, you can display, the form alone, the index alone, or a split screen showing part of both; it's a format similar to the Windows 95 Explorer. The forms tab lets you display four different groupings of forms: all forms; those you've visited; those you've actively used; and primary IRS forms and schedules. You can enter data on the forms even while the split screen is active, but the documents are sometimes difficult to read, even when they're open full-screen.

Clicking on a help icon pops up a tabbed file folder box offering four kinds of help: information on using Simply Tax, IRS instructions, explanations from a CPA, and help on the help system itself. A summary of your up-to-the-minute tax obligation is always available, and there's a final audit to look for errors, omissions, and other problems.

Still, we find it difficult to recommend Simply Tax unless you want a fast import of your data from the previous year's version. It simply does not offer any advantages over its competitors in any area, and the planning version we looked at felt unfinished. But if 4Home Productions puts as much effort into pulling Simply Tax's interface together as it did this year, adds more content and usability in areas like guidance and the Tax Wizard, and makes the forms screens more readable and easily navigated, the product could well be a contender next time around.

Simply Tax. List price: \$19.95. 4Home Productions, Islandia, NY; 800-773-5445, 516-342-2000; fax, 800-816-5550; <http://www.cai.com/4home/4home.html>. Circle 443 on reader service card.

REPORT CARD

Simply Tax

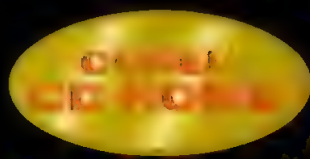
Preparation	B
Guidance	C
Audit/review	C

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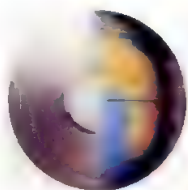
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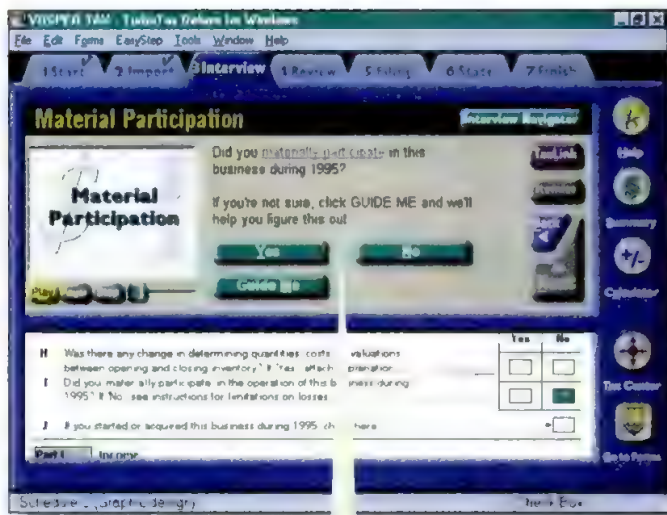
TurboTax Deluxe

Three years ago, Intuit debuted a new user interface for TurboTax called EasyStep, which set a new standard for automated data entry in tax preparation software. Every year since then, this powerful tool has evolved to where, in 1996, it's one of the most attractive, usable interfaces ever designed for a personal or business productivity application. It's certainly the best among the four personal tax preparation packages we review here.

Intuit has incorporated several new time-saving conventions this year, polished an already-appealing interface

even more, and extended the program's reach. The final version is expected to include a special edition of Netscape Navigator so users can get free access to the Intuit Web site via The Quicken Financial Network. In addition, TaxLink, the interactive link with Quicken that Intuit added last year, will allow data import from QuickBooks for Windows in the final release.

As painless as Intuit's EasyStep interview process is, TurboTax Deluxe (\$49.95) makes it even easier by offering a Fast Track option. If you elect to take this route, you'll go through several screens full of lists outlining income and expense items covered on the 1040. EasyStep will take you through only



TurboTax Deluxe anticipates spots where you might not know how to answer, then offers a bit more guidance to help you decide.

those areas you've checked off on the lists, saving you time. If you're not absolutely sure you'll recognize everything you need to report, it's best to go through every

Tax Preparation for OS/2, Too

By Kathy Yakal

Last year, BT&T Technology (800-672-8293) introduced TaxDollars a tax preparation program developed solely for OS/2. We were unable to review it because it didn't include enough forms to accommodate our testing script. Unfortunately, the same holds true this year, although the 1995 version of TaxDollars includes more forms—and costs a bit more—than the previous release.

The 1994 version of TaxDollars was available for nothing more than the cost of shipping. This year, the final version of the package costs \$17.95, plus \$7.00 for shipping. You do get more forms for your money (18 in all) including Forms 1040, 1099, 2160, 2441, and 8829; Schedules A, B, C, D, E, EIC, R, and SE; W-2 Wage and Tax Statement; and Direct Deposit with 1040PC Format.

Function keys and color-coding are used in much the same way as they are in other tax prep programs. Blue fields, for example, derive their totals from supporting forms and schedules. Other

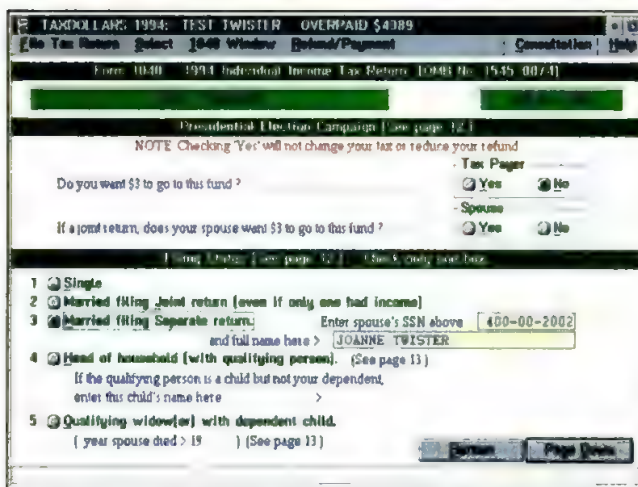
elements of the program's interface are similarly usable. You use pull-down menus, function keys, and keystroke combinations for most basic functions.

TaxDollars offers limited guidance and feedback, but it does have a few nice features. You can create what-if scenarios to see what effect a numeric adjustment would have, and you can check for errors and omissions by running a review of your return. The Tax Tips file provides a list of the most commonly overlooked deductions. You can also see a list of

tax law changes for 1995 and view a 3-D bar or pie chart that graphically illustrates your tax situation.

TaxDollars prints IRS-approved forms and schedules, and it can generate a 1040PC, but it does not support electronic filing.

TaxDollars has a lot of growing to do before it can compete with the leaders in the tax prep software market. But if you're an OS/2 user who is loathe to use another operating system's software, TaxDollars may just handle your 1995 tax preparation needs.



Tax Dollars is a good choice for OS/2 users who don't mind entering data directly onto an on-screen 1040.



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screen in EasyStep, but Fast Track can save a lot of time for more savvy users.

There are often times when you may have to fill in only a few lines on a particular form or schedule. EasyStep saves time here by letting you either go through the whole document one line at a time, or select only the lines or boxes you need to fill in. If you choose the latter option, a drop-down list lets you select just what information you need to supply before moving on to the next entry. At any point in EasyStep, you can click on the Interview Navigator button to see two lists: an accounting of every line where you've entered data and what it was, and an outline of the Interview's main topics. You can

launch out to any topic from the list itself. This outline, however, is not as detailed as the Q&A topic list in Kiplinger TaxCut.

Large, clearly marked icons provide other services along the way. The Help button opens a tabbed dialog box offering program and tax help, cross-references, and IRS instructions. You can also access the expert advice included in TurboTax Deluxe from here: Mary Sprouse's *The Money Income Tax Handbook*, Jeff Schnepfer's *How To Pay Zero Taxes*, and 30 official IRS publications. These are available in the Tax Center too. This reference area offers tax strategies, a library of tax-related video clips, and a guided tour.

Noted tax experts Mary Sprouse and Marshall Loeb appear in many of the video clips sprinkled throughout the program to provide multimedia guidance.

If you prefer to enter data directly on forms, you'll find that path clear and well marked. Icons and menus make it easy to complete your return and to visit the Interview when needed.

TurboTax's final wrap-up is as thorough and usable as the rest of the program. You can choose from among four different types of reviews, or opt to run all four. TurboTax does the standard checks for errors, omissions and possible audit triggers, and it combs your return for deductions you may have missed and offers tax-saving suggestions.

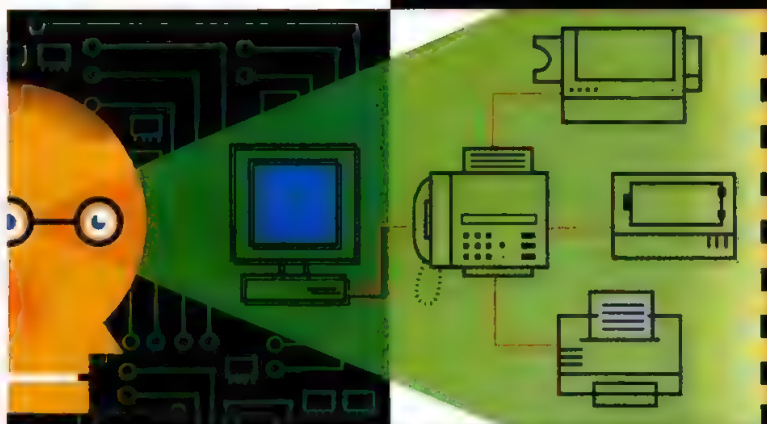
Although we did not re-

view it here, Intuit also announced a separate version, called TurboTax for Business. It looks and feels like the personal version, but it's designed for small business owners, and offers business-specific tax advice and planning information. TurboTax for Business is expected to cost \$70.

Intuit has designed a program whose guidance is trustworthy and whose tax processing tools are reliable, then wrapped it all up in an interface that rivals the best available in any category of application software. It's clearly this year's best. □

TurboTax Deluxe. List price: \$49.95. Intuit Inc., Personal Tax Group, San Diego, CA; 800-964-1040, 619-453-4446; fax, 800-756-1040; <http://www.intuit.com/TurboTax>. Circle 444 on reader service card.

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Advertisers' Index COMPANIES

Reader Service No.	Advertiser	Page
293	3 Com Corporation	46-47
021	3 Com Corporation	201
*	Acer America	38
*	Acer America	159-162
*	Adaptec	137
218	Adaptec	139
117	Adaptec	195
226	ADI Systems Inc	62
162	American Power Conversion	318-319
235	AMS	144-145
336	ARLINGTON COMPUTER PRODUCTS	260
328	Artisoft Inc.	26-27
122	AST Research	98-99
012	Austin Direct	183-185
292	Caere Corporation	6
*	Canon Computer Systems	306-307
284	Castelle	332
*	Compaq Computer Corporation	104-105
387	CompuLink Research	241
025	CompUSA Direct	232-233
348	Computer Associates	2-3
159	COMPUTER DISCOUNT WAREHOUSE	250-251
318	COMPUTER DISCOUNT WAREHOUSE	252-253
*	Computer Telephony Expo	97
076	Connectix	96
369	Connectix	208
224	Conner Peripherals	23
322	Corel Corporation	30
042	Corel Corporation	141
358	Corel Corporation	174
044	Corel Corporation	197
037	Corel Corporation	312-313
011	Corel Corporation	320
332	Corel Corporation	327
041	Corel Corporation	331
286	CTX International	74
329	CTX International	165
*	Dell Computer Corporation	68
*	Dell Computer Corporation	86-87
*	Dell Computer Corporation	C5-C8
*	Dell Computer Corporation	166-167
101	Diamond Multimedia Systems	323
388	Digital Equipment Corporation	58-59
201	DTK Computer	28
*	Epson America	10-11
090	Everex Computer Systems	172

Reader Service No.	Advertiser	Page
014	First Source International	258-259
861	FTP Software Inc	NE11
*	Gateway 2000	48A-H
*	Gateway 2000	49
*	Gateway 2000	187-190
391/138	H.Co Memory Upgrades	271
062	HARTFORD COMPUTER GROUP	229
136	Hayes Microcomputer Products	179
*	Hewlett Packard Peripheral Group	78-79
*	Hewlett Packard Peripheral Group	142-143
*	Hewlett Packard Peripheral Group	168-169
*	Hewlett Packard	81
*	IBM Corporation	5
*	IBM Corporation	115
*	IBM PC Corporation	42
278	Insight Direct	235
219	Insight Direct	236-237
027	Insight Direct	238-239
167	Insight Direct	304
*	Intel Corporation	13
106	Kingston Technology	171
019	L.A. Trade	245
*	Lotus Development Corporation	NE19-NE42
165	Magitronic	231
015	Magnavox	128-129
084	MAXTECH CORPORATION	311
018	MEGAHAUS	249
*	Megahertz Corp	32-33
855	Micro Solutions Computer Products	270
361	Micrografx	67
214	Microhelp Inc.	35
119	Micron Electronics	14-17
203	Micron Electronics	88
164	Micron Electronics	121-126
924	Micron Electronics	NE2-NE3
151	Micron Electronics/Zeos Division	52-53
*	Microsoft	64-65
*	Microsoft	72
*	Microsoft	C2-C4, p1
*	Microsoft	109
*	Microsoft	111
*	Microsoft	113
010	Midwest Computer Works	242-243
398	Midwest Micro	262
028	NEBS, Inc.	317
153	NEC Technologies	82-83

Reader Service No.	Advertiser	Page
157	NEC Technologies	106-107
906	NEC Technologies	NE9
877	NetManage, Inc	NE45
892	Octopus Technologies, Inc	NE17
*	Oracle Corp	NE5
*	PC Connection	261
330	PC Mall	269
080	PC Power & Cooling	94
199	PC Zone	264-265
092	PCs Compleat	254-255
268	PCs Compleat	256-257
867	Performance Technology	NE58
148	Primavera Systems	61
067	Princeton Graphic Systems	212
056	Pro Direct	268
884	QMS	NE7
339	Quarterdeck Office Systems	55
338	Quarterdeck Office Systems	57
309	S.A.G./Storage Solutions	149
033	Samsung	134
256	SCEPTRE Technologies	315
271	Seagate Technology	132
248	Simple Technology	84
*	Sony Computer Peripherals	24-25
043	SPSS, Inc.	263
*	STAC Electronics	50
057	StatSoft	45
308	Symantec Corporation	18
246	Texas Instruments	118-119
379	Toshiba America	70-71
*	Touche	90
051	USA Flex	246-247
118	View Sonic	217
239	Viking Components	92
*	Visio	199
250	Visual Software	321
085	WinBook Computer Corporation	77
864	Wollongong Group	NE14-NE15
163	Xerox Corporation	325
211	Xircom	193
*	Zenith Data Systems	20-21

* No Reader Service #. Please Call Advertiser For Information.

Advertisers' Index PRODUCTS

Reader Service No.	Company	Product	Page	Reader Service No.	Company	Product	Page
ACCELERATOR BOARDS				ELECTRONIC MAIL			
101	Diamond Multimedia Systems	Stealth 64	323	Lotus Development Corporation			
855	Micro Solutions Computer Products	Disk Drive, Tape BackUP, CD-ROM	270	Microsoft			
ACCOUNTING SOFTWARE				Microsoft			
028	NEBS, Inc.	One Write Plus	317	Microsoft			
ADD-ON BOARDS				EMULATORS/PROTOCOL CONVERTERS			
391/138	H Co Memory Upgrades	Memory, PCMCIA	271	861	FTP Software Inc.	Explore On Net	NE11
	Intel Corporation	Intel Ethernet Adapter	13	ENTERTAINMENT SOFTWARE			
BACKUP SOFTWARE				322	Corel Corporation	Children's Home Series	30
162	American Power Conversion	Back-UPS PRO PnP	318-319	042	Corel Corporation	Flow 3, 4, 5	141
855	Micro Solutions Computer Products	Tape BackUP	270	044	Corel Corporation	Xara	197
892	Octopus Technologies, Inc.	NT Fault Tolerant Software	NE17	332	Corel Corporation	Movie Guide	327
CAD/CAM				041	Corel Corporation	Artshow 6	331
	Visio	Visio Technical	199	FAX/MODEM			
CD-ROM				293	3 Com Corporation	PC Card/Fax/Modem	46-47
042	Corel Corporation	Flow 3, 4, 5	141	014	First Source International	Memory Software Notebooks	258-259
011	Corel Corporation	Medical Series	320		Megahertz Corp.	XJack PCMCIA V.34 Modem	32-33
332	Corel Corporation	Movie Guide	327	163	Xerox Corporation	Xerox Document WorkCenter 250	325
041	Corel Corporation	Artshow 6	331	FLOWCHARTING			
014	First Source International	Memory, Software, Notebooks	258-259	358	Corel Corporation	Flow 3	174
855	Micro Solutions Computer Products	CD-ROM	270	361	Micrografx	ABC Graphics Suite	67
157	NEC Technologies	CD-ROM	106-107		Microsoft	Microsoft Project	64-65
	STAC Electronics	Reach Out	50		Visio	Visio Technical	199
CHIPS/PROCESSORS				GRAPHICAL INTERFACE			
014	First Source International	Memory, Software, Notebooks	258-259		Acer America	Aspire	38
391/138	H Co Memory Upgrades	Memory, PCMCIA	271	GRAPHICS SOFTWARE			
106	Kingston Technology	Kingston Memory	171	292	Caere Corporation	OmniPage	6
019	L.A. Trade	Memory	245	358	Corel Corporation	Flow 3	174
248	Simple Technology	Memory	84	037	Corel Corporation	Design Contest	312-313
CO-PROCESSORS					Visio	Visio Technical	199
	Intel Corporation	Intel Ethernet Adapter	13	250	Visual Software	Instant 3D	321
COMMUNICATIONS SOFTWARE				HAND-HELD PC'S			
861	FTP Software Inc.	Explore On Net	NE11		Hewlett Packard	HP OmniBook	81
877	NetManage, Inc.	Chameleon 4.5	NE45	HARD DRIVES			
308	Symantec Corporation	Win 95 - Navigator	18	278	Insight Direct	Mail Order	235
864	Wolfgang Group	Emissary	NE14-NE15	219	Insight Direct	Mail Order	236-237
COMPUTERS/COMPATIBLES				027	Insight Direct	Mail Order	238-239
	Acer America	Aspire	38	167	Insight Direct	Mail Order	304
235	Acer America	Notebooks	159-162	018	MEGAHAUS	Mass Storage	249
336	AMS	Notebooks	144-145	855	Micro Solutions Computer Products	Disk Drive	270
122	ARLINGTON COMPUTER PRODUCTS	Peripherals	260	056	Pro Direct	Mail Order	268
012	AST Research	Computers	98-99	HARDWARE			
012	Austin Direct	Austin Desktops & Notebooks	183-185	293	3 Com Corporation	PC Card/Fax/Modem	46-47
387	Compaq Computer Corporation	Desktops	104-105	021	3 Com Corporation	Corporate Ad	201
025	CompuLink Research	Infinity	241	162	American Power Conversion	Back-UPS PRO PnP	318-319
159	CompUSA Direct	Mail Order	232-233	235	AMS	Notebooks	144-145
318	COMPUTER DISCOUNT WAREHOUSE	Hardware	250-251	012	Austin Direct	Austin Desktops & Notebooks	183-185
	COMPUTER DISCOUNT WAREHOUSE	Hardware	252-253	284	Canon Computer Systems	Canon Bubble Jet Printers	306-307
	Dell Computer Corporation	Dell Dimension XPS PRO150	68	076	Castelle	Personal Fax Printer	332
388	Dell Computer Corporation	Platinum/Limeade	86-87	286	CompuLink Research	Infinity	241
201	Dell Computer Corporation	Dell Desktops and Notebooks	C5-C8	329	Connectix	Video Phone	96
090	Dell Computer Corporation	Dell Dimension	166-167	101	CTX International	Monitor	74
	Digital Equipment Corporation	Digital PCs	58-59	388	CTX International	Notebooks	165
	DTK Computer	Systems	28	090	Dell Computer Corporation	Dell Dimension XPS PRO150	68
	Everex Computer Systems	Pentium Processor Systems	172		Dell Computer Corporation	Platinum/Limeade	86-87
	Gateway 2000	Pentium PC	49	136	Dell Computer Corporation	Dell Dimension	166-167
062	Gateway 2000	PCs	187-190		Diamond Multimedia Systems	Stealth 64	323
	HARTFORD COMPUTER GROUP	Mail Order	229	398	Digital Equipment Corporation	Digital PCs	58-59
	Hewlett Packard	HP OmniBook	81	153	Everex Computer Systems	Pentium Processor Systems	172
	Hewlett Packard Peripheral Group	HP Vectra PCs	78-79	157	Hayes Microcomputer Products	Hayes Century Rack System	179
	IBM Corporation	Aptiva	115	906	Hewlett Packard	HP OmniBook	81
	IBM PC Corporation	Client/Server	42	080	Hewlett Packard Peripheral Group	HP Vectra PCs	78-79
278	Insight Direct	Mail Order	235	056	IBM PC Corporation	Client/Server	42
219	Insight Direct	Mail Order	236-237	884	Insight Direct	Mail Order	235
027	Insight Direct	Mail Order	238-239	309	Insight Direct	Mail Order	236-237
167	Insight Direct	Mail Order	304	033	Insight Direct	Mail Order	238-239
165	Magitronic	Magitronic Notebook	231	256	Insight Direct	Mail Order	304
084	MAXTECH CORPORATION	Notebooks	311	118	Kingston Technology	Kingston Memory	171
203	Micron Electronics	Micron PCs	88	239	Magitronic	Magitronic Notebook	231
184	Micron Electronics	Micron PCs	121-126		Magnavox	Magnavox Monitors	128-129
010	Midwest Computer Works	PCs	242-243		MEGAHAUS	Mass Storage	249
398	Midwest Micro	Desktop Systems	262		Megahertz Corp	XJack PCMCIA V.34 Modem	32-33
199	PC Connection	Mail Order	261		Midwest Micro	Desktops, Notebooks, Peripherals	262
092	PC Zone	Mail Order	264-265		NEC Technologies	Monitors	82-83
268	PCs Complete	Mail Order	254-255		NEC Technologies	CD-ROM	106-107
309	PCs Complete	Mail Order	256-257		NEC Technologies	NEC Risc Server	NE9
379	S.A.G./Storage Solutions	Pentiums	149		PC Connection	Mail Order	261
051	Toshiba America	Notebook Computers	70-71		PC Power	Hardware	269
	USA Flex	Desktop PCs	246-247		PowerProtection & Cooling Devices		94
DATA BASE MANAGERS					Pro Direct	Mail Order	268
348	Computer Associates	Unicenter	2-3		QMS	1660 E	NE7
	Lotus Development Corporation	Lotus Source	NE19-NE42		S.A.G./Storage Solutions	Pentiums, Servers	149
	Oracle Corp.	Workgroup 2000	NE5		Samsung	Samsung Notebooks	134
DATA COMPRESSION SOFTWARE					SCEPTRE Technologies	Notebook	315
369	Connectix	RAM Doubler	208		Simple Technology	Memory	84
DISK BACKUP & TAPE DRIVES					View Sonic	Monitors	217
855	Micro Solutions Computer Products	Disk Drive & Tape BackUP	270		Viking Components	Memory	92
DISPLAYS/MONITORS				INPUT DEVICES			
226	ADi Systems Inc.	Monitors	62		Touche	Touche Touch Pad	90
286	CTX International	Monitor	74	LAN ADAPTER BOARDS			
015	Magnavox	Magnavox Monitors	128-129		Intel Corporation	Intel Ethernet Adapter	13
084	MAXTECH CORPORATION	Monitors	311	LANGUAGES			
010	Midwest Computer Works	Monitors	242-243		Microsoft	Access Developer Toolkit	72
153	NEC Technologies	Monitors	82-83	LAPTOPS/PORTABLE COMPUTERS			
067	Princeton Graphic Systems	Monitors	212		Acer America	Notebooks	159-162
118	Sony Computer Peripherals	Monitors	24-25	235	AMS	Notebooks	144-145
	View Sonic	Monitors	217	122	AST Research	Computers	98-99
EDUCATIONAL SOFTWARE				012	Austin Direct	Austin Desktops & Notebooks	183-185
322	Corel Corporation	Children's Home Series	30	025	CompUSA Direct	Mail Order	232-233
042	Corel Corporation	Flow 3, 4, 5	141	159	COMPUTER DISCOUNT WAREHOUSE	Laptops	250-251
044	Corel Corporation	Xara	197	318	COMPUTER DISCOUNT WAREHOUSE	Laptops	252-253
011	Corel Corporation	Medical Series	320	329	CTX International	Notebooks	165
041	Corel Corporation	Artshow 6	331		Dell Computer Corporation	Platinum/Limeade	86-87

Advertisers' Index PRODUCTS

Reader Service

No.	Company	Product	Page
062	Gateway 2000	Notebooks	187-190
165	Gateway 2000	Notebooks	48A-H
119	HARTFORD COMPUTER GROUP	Mail Order	229
151	Hewlett Packard	HP OmniBook	81
010	Magitronic	Magitronic Notebook	231
398	Megahertz Corp	XJack PCMCIA V 34 Modem	32-33
199	Micron Electronics	Micron Notebooks	14-17
033	Micron Electronics/Zeos Division	Mendian Color Notebooks	52-53
256	Midwest Computer Works	Hardware	242-243
246	Midwest Micro	Notebooks	262
379	PC Zone	Mail Order	264-265
051	Samsung	Samsung Notebooks	134
085	SCEPTRE Technologies	Notebook	315
062	Texas Instruments	TI Notebooks	118-119
062	Toshiba America	Notebook Computers	70-71
062	USA Flex	Notebooks	246-247
062	WinBook Computer Corporation	Winbook	77
062	Zenith Data Systems	Notebooks	20-21

LOCAL AREA NETWORKING

293	3 Com Corporation	PC Card/Fax/Modem	46-47
021	3 Com Corporation	Corporate Ad	201
284	Castelle	Personal Fax Printer	332
348	Computer Associates	Unicenter	2-3
159	COMPUTER DISCOUNT WAREHOUSE	Networking Products	250-251
318	COMPUTER DISCOUNT WAREHOUSE	Networking Products	252-253
062	HARTFORD COMPUTER GROUP	Mail Order	229
062	IBM PC Corporation	Client/Server	42
062	Intel Corporation	Intel Ethernet Adapter	13
906	NEC Technologies	NEC Risc Server	NE9
892	Octopus Technologies, Inc	NT Fault Tolerant Software	NE17
867	Performance Technology	Instant Internet	NE58
309	S.A.G./Storage Solutions	Pentiums, Servers	149
062	STAC Electronics	Reach Out	50

MAIL ORDER

336	ARLINGTON COMPUTER PRODUCTS	Mail Order	260
012	Austin Direct	Austin Desktops & Notebooks	183-185
062	Compag Computer Corporation	Desktops	104-105
387	CompuLink Research	Infinity	241
025	CompUSA Direct	Mail Order	232-233
159	COMPUTER DISCOUNT WAREHOUSE	Resellers	250-251
318	COMPUTER DISCOUNT WAREHOUSE	Resellers	252-253
201	DTK Computer	Systems	28
014	First Source International	Memory, Software, Notebooks	258-259
062	Gateway 2000	Mail Order	49
062	Gateway 2000	Mail Order	187-190
062	Gateway 2000	Mail Order	48A-H
391/138	H Co Memory Upgrades	Memory, PCMCIA, Fax/Modem, LAN	271
062	IBM Corporation	Aptiva	115
278	Insight Direct	Mail Order	235
219	Insight Direct	Mail Order	236-237
027	Insight Direct	Mail Order	238-239
167	Insight Direct	Mail Order	304
165	Magitronic	Magitronic Notebook	231
018	MEGAHAUS	Mass Storage	249
151	Micron Electronics/Zeos Division	Mendian Color Notebooks	52-53
010	Midwest Computer Works	Mail Order	242-243
330	PC Mail	Hardware Software Peripherals	269
199	PC Zone	Mail Order	264-265
092	PCs Compleat	Mail Order	254-255
268	PCs Compleat	Mail Order	256-257
056	Pro Direct	Mail Order	268
051	USA Flex	Desktops, Notebooks, Printers	246-247

MASS STORAGE

224	Conner Peripherals	Tape Drives	23
018	MEGAHAUS	Mass Storage	249
855	Micro Solutions Computer Products	Disk Drive, Tape BackUP	270
309	S.A.G./Storage Solutions	Storage Solutions	149
271	Seagate Technology	Hard Drives	132

MEMORY

369	Connectix	RAM Doubler	208
014	First Source International	Memory, Software, Notebooks	258-259
391/138	H Co Memory Upgrades	Memory	271
106	Kingston Technology	Kingston Memory	171
019	L.A. Trade	Memory	245
056	Pro Direct	Mail Order	268
339	Quarterdeck Office Systems	MagnaRAM	55
248	Simple Technology	Memory	84
239	Viking Components	Memory	92

MISCELLANEOUS

062	Computer Telephony Expo	Tradeshaw	97
062	Hewlett Packard Peripheral Group	HP CopyJet Printer	142-143
062	Hewlett Packard Peripheral Group	HP 5SiMX Network Printer	168-169
855	Micro Solutions Computer Products	Disk Drive, Tape BackUP, CD-ROM	270
062	Touche	Touche Touch Pad	90

MODEMS

293	3 Com Corporation	PC Card/Fax/Modem	46-47
136	Hayes Microcomputer Products	Hayes Century Rack System	179
084	MAXTECH CORPORATION	Modems	311
056	Megahertz Corp	XJack PCMCIA V 34 Modem	32-33
211	Pro Direct	Mail Order	268
062	Xircom	CIMM	193

MULTI-MEDIA

025	CompUSA Direct	Mail Order	232-233
076	Connectix	Video Phone	96
101	Diamond Multimedia Systems	Stealth 64	323
062	Epson America	Printer	10-11
062	HARTFORD COMPUTER GROUP	Mail Order	229
855	Micro Solutions Computer Products	CD-ROM	270
157	NEC Technologies	CD-ROM	106-107
330	PC Mail	Hardware Software Peripherals	269
199	PC Zone	Mail Order	264-265
092	PCs Compleat	Mail Order	254-255
268	PCs Compleat	Mail Order	256-257
118	Sony Computer Peripherals	Monitors	24-25
062	View Sonic	Monitors	217

MULTIMEDIA SOFTWARE

037	Corel Corporation	Design Contest	312-313
011	Corel Corporation	Medical Series	320
250	Visual Software	Instant 3D	321

NETWORK INTERFACE CARDS

062	Intel Corporation	Intel Ethernet Adapter	13
211	Xircom	CIMM	193

Reader Service

No.	Company	Product	Page
328	Artisoft Inc.	LANtastic	26-27
348	Computer Associates	Unicenter	2-3
861	FTP Software Inc	Explore On Net	NE11
892	Octopus Technologies, Inc	NT Fault Tolerant Software	NE17
867	Oracle Corp	Workgroup 2000	NE5
338	Performance Technology	Instant Internet	NE58
339	Quarterdeck Office Systems	Cleansweep	57
062	Quarterdeck Office Systems	MagnaRAM	55
062	STAC Electronics	Reach Out	50

ON LINE DATABASE

062	Microsoft	Microsoft Network	109
062	Microsoft	Microsoft Network	111
062	Microsoft	Microsoft Network	113

OPERATING SYSTEMS

328	Artisoft Inc.	LANtastic	26-27
-----	---------------	-----------	-------

OPTICAL PERIPHERALS

163	Xerox Corporation	Xerox Document WorkCenter 250	325
-----	-------------------	-------------------------------	-----

ORGANIZATIONAL SOFTWARE

062	Microsoft	Microsoft Project	64-65
-----	-----------	-------------------	-------

PC ACCESSORIES

855	Micro Solutions Computer Products	Disk Drive, Tape BackUP, CD-ROM	270
-----	-----------------------------------	---------------------------------	-----

PC DIRECT

336	ARLINGTON COMPUTER PRODUCTS	Mail Order	260
387	CompuLink Research	Infinity	241
025	CompUSA Direct	Mail Order	232-233
159	COMPUTER DISCOUNT WAREHOUSE	Resellers	250-251
318	COMPUTER DISCOUNT WAREHOUSE	Resellers	252-253
014	First Source International	Memory, Software, Notebooks	258-259
391/138	H Co Memory Upgrades	Memory, PCMCIA, Fax/Modem, LAN	271
062	HARTFORD COMPUTER GROUP	Mail Order	229
278	Insight Direct	Mail Order	235
219	Insight Direct	Mail Order	236-237
027	Insight Direct	Mail Order	238-239
167	Insight Direct	Mail Order	304
019	L.A. Trade	Memory	245
165	Magitronic	Magitronic Notebook	231
018	MEGAHAUS	Mass Storage	249
855	Micro Solutions Computer Products	Disk Drive, Tape BackUP, CD-ROM	270
010	Midwest Computer Works	Mail Order	242-243
398	Midwest Micro	Desktops, Notebooks, Peripherals	262
330	PC Connection	Mail Order	261
199	PC Mail	Hardware, Software, Peripherals	269
092	PC Zone	Mail Order	264-265
268	PCs Compleat	Mail Order	254-255
056	PCs Compleat	Mail Order	256-257
043	Pro Direct	Mail Order	268
051	SPSS, Inc.	Statistical & Windows Software	263
051	USA Flex	Desktops, Notebooks, Printers	246-247

PCMCIA

062	Adaptec	SCSI Adapters	137
218	Adaptec	SCSI Adapters	139
117	Adaptec	SCSI Adapters	195
391/138	H Co Memory Upgrades	Fax/Modem, Flash, SRAM, Drives	271
062	Megahertz Corp	XJack PCMCIA V 34 Modem	32-33
211	Xircom	CIMM	193

PERIPHERAL SHARING DEVICE

136	Hayes Microcomputer Products	Hayes Century Rack System	179
-----	------------------------------	---------------------------	-----

PERIPHERALS

293	3 Com Corporation	PC Card/Fax/Modem	46-47
159	COMPUTER DISCOUNT WAREHOUSE	Peripherals	250-251
318	COMPUTER DISCOUNT WAREHOUSE	Peripherals	252-253
101	Diamond Multimedia Systems	Stealth 64	323
062	Epson America	Printer	10-11
062	Gateway 2000	Peripherals	49
062	Gateway 2000	Peripherals	187-190
062	Gateway 2000	Peripherals	48A-H
136	Hayes Microcomputer Products	Hayes Century Rack System	179
062	Hewlett Packard Peripheral Group	HP CopyJet Printer	142-143
062	Hewlett Packard Peripheral Group	HP 5SiMX Network Printer	168-169
015	Magnavox	Magnavox Monitors	128-129
084	MAXTECH CORPORATION	Peripherals	311
855	Micro Solutions Computer Products	Disk Drive, Tape BackUP, CROM	270
398	Midwest Micro	Peripherals	262
330	PC Connection	Mail Order	261
199	PC Mail	Peripherals	269
884	PC Zone	Mail Order	264-265
062	OMS	1660 E	NE7
163	Touche	Touche Touch Pad	90
163	Xerox Corporation	Xerox Document WorkCenter 250	325

POWER PROTECTION

162	American Power Conversion	Back-UPS PRO PnP	318-319
080	PC Power & Cooling	PowerProtection&CoolingDevices	94

PRESENTATION SOFTWARE

062	Microsoft	Microsoft Office	C2-C4 p1
-----	-----------	------------------	----------

PRINTER ACCESSORIES

284	Castelle	Personal Fax Printer	332
051	USA Flex	Peripherals	246-247

PRINTERS

062	Epson America	Printer	10-11
062	Hewlett Packard Peripheral Group	HP CopyJet Printer	142-143
062	Hewlett Packard Peripheral Group	HP 5SiMX Network Printer	168-169
884	OMS	1660 E	NE7
051	USA Flex	Printers	246-247
163	Xerox Corporation	Xerox Document WorkCenter 250	325

PROGRAM DEVELOPERS

062	Microsoft	Access Developer Toolkit	72
-----	-----------	--------------------------	----

PROGRAMMERS TOOLS UTILITIES

348	Computer Associates	Unicenter	2-3
062	Microsoft	Access Developer Toolkit	72

PROJECT MANAGEMENT

062	Microsoft	Microsoft Project	64-65
-----	-----------	-------------------	-------

Advertisers' Index PRODUCTS

Reader Service

Reader Service No.	Company	Product	Page
148	Primavera Systems	Suretrak	61
REMOTE COMPUTING			
*	Hewlett Packard	HP OmniBook	81
*	Microsoft	Microsoft Network	109
*	Microsoft	Microsoft Network	111
*	Microsoft	Microsoft Network	113
308	Symantec Corporation	Win 95 - Navigator	18
RENTALS/LEASING			
062	HARTFORD COMPUTER GROUP	Mail Order	229
RESELLERS			
010	Midwest Computer Works	Reseller	242-243
SCANNERS			
*	Canon Computer Systems	Canon Bubble Jet Printers	306-307
163	Xerox Corporation	Xerox Document WorkCenter 250	325
SERVERS			
012	Austin Direct	Austin Desktops & Notebooks	183-185
284	Castelle	Personal Fax Printer	332
090	Everex Computer Systems	Pentium Processor Systems	172
*	IBM PC Corporation	Client/Server	42
924	Micron Electronics	Micron Servers	NE2-NE3
908	NEC Technologies	NEC Risc Server	NE9
309	S.A.G./Storage Solutions	Servers	149
*	STAC Electronics	Reach Out	50
SERVICE/SUPPORT			
084	MAXTECH CORPORATION	Peripherals	311
SOFTWARE			
328	Artisoft Inc.	LANtastic	26-27
369	Connectix	RAM Doubler	208
*	IBM Corporation	IBM Software	5
278	Insight Direct	Mail Order	235
219	Insight Direct	Mail Order	236-237
027	Insight Direct	Mail Order	238-239
167	Insight Direct	Mail Order	304
361	Micrografx	ABC Graphics Suite	67
214	Microhelp Inc.	Uninstaller	35
*	Microsoft	Microsoft Project	64-65
*	Microsoft	Access Developer Toolkit	72
*	Microsoft	Microsoft Office	C2-C4 p1
*	Microsoft	Microsoft Network	109
*	Microsoft	Microsoft Network	111
*	Microsoft	Microsoft Network	113
877	NetManage, Inc.	Chameleon 4.5	NE45
*	Oracle Corp.	Workgroup 2000	NE5
330	PC Mail	Mail Order	261
148	Primavera Systems	Software	269
043	SPSS, Inc.	Suretrak	61
308	Symantec Corporation	Statistical & Windows Software	263
*	Visio	Win 95 - Navigator	18
250	Visual Software	Visio Technical	199
		Instant 3D	321
SPREADSHEET/TEMPLATES			
*	Microsoft	Microsoft Office	C2-C4 p1
STATISTICAL SOFTWARE			
043	SPSS, Inc.	Statistical Software	263
057	StatSoft	Statistical Software	45
TCP/IP			
877	NetManage, Inc.	Chameleon 4.5	NE45
864	Wollongong Group	Emissary	NE14-NE15
TELECOMMUNICATIONS			
*	Computer Telephony Expo	Tradeshaw	97
*	Microsoft	Microsoft Network	109
*	Microsoft	Microsoft Network	111
*	Microsoft	Microsoft Network	113
UTILITIES			
214	Microhelp Inc.	Uninstaller	35
338	Quarterdeck Office Systems	Cleansweep	57
339	Quarterdeck Office Systems	MagnaRAM	55
VIDEO GRAPHICS/BOARDS			
101	Diamond Multimedia Systems	Stealth 64	323
WINDOWS SOFTWARE			
025	CompUSA Direct	Mail Order	232-233
348	Computer Associates	Unicenter	2-3
369	Connectix	RAM Doubler	208
361	Micrografx	ABC Graphics Suite	67
214	Microhelp Inc.	Uninstaller	35
*	Microsoft	Microsoft Project	64-65
*	Microsoft	Access Developer Toolkit	72
*	Microsoft	Microsoft Office	C2-C4 p1
877	NetManage, Inc.	Chameleon 4.5	NE45
330	PC Mail	Software	269
148	Primavera Systems	Suretrak	61
043	SPSS, Inc.	Windows Software	263
*	STAC Electronics	Reach Out	50
057	StatSoft	Statistical Software	45
*	Visio	Visio Technical	199
250	Visual Software	Instant 3D	321
864	Wollongong Group	Emissary	NE14-NE15
WORK GROUP SOFTWARE			
*	Lotus Development Corporation	Lotus Source	NE19-NE42
WORKSTATIONS			
*	Hewlett Packard Peripheral Group	HP Vectra PCs	78-79
309	S.A.G./Storage Solutions	Pentiums, Servers	149

For Additional Categories see MARKETPLACE PRODUCT INDEX Page 272



Coming Up

World Wide Web Browsers

Netscape's Navigator commands the lion's share of the World Wide Web browser market, but there's plenty of healthy, technically advanced competition out there to keep Netscape on its toes. In fact, we've never seen so many impressive new entrants appear in a single software category in such a short space of time. Our reviews of a dozen major Web browsers, all in significantly updated new editions, will keep you up to speed with this rapidly changing category. Our task-centric testing will help you find the best tools for straightforward Web browsing, viewing advanced HTML, taking advantage of proprietary HTML extensions, and accessing multimedia.

Mass Storage

If you're like most users, you face an ongoing problem: where to keep those megabytes of information that bombard you daily. Memory-hungry applications hog your hard disk, leaving you ever-dwindling capacity to archive your e-mail threads, multimedia presentations, and all the data you download off the Web.

The solution: expandable storage. PC users can now get unlimited capacity from any of the new breed of drives that feature removable, rewritable media. Unlike tape drives, these units offer true random access to data, and some offer great portability so that you can take gigabytes of information wherever you need. We review 14 of the latest products (including magneto-optical, phase change, and proprietary cartridges from Iomega and SyQuest).

Presentation Graphics

Whether you're a salesperson, an administrator, a CEO, or just someone who needs to produce a presentation from a stack of scribbled notes or a document of outlined points, our review of nine presentation graphic products will show you how software can turn your text into stunning slide shows. Some presentation packages focus on streamlined simplicity, others on extensive elaboration. But nearly all offer a variety of stylish templates, tons of color, graphics to accompany your text, and shapes and charts of many sorts and sizes to illustrate your points. We'll tell you which products can help you create automated, well-developed presentations that will surely dazzle your audience.

Web Browser OCXs

The latest wrinkle in OLE custom controls (OCXs) are Internet controls that let you perform feats like dropping a fully functioning World Wide Web browser into your Internet application without writing a line of code.

Editorial Product Index

Reader Service No.	Product	Company	Page
456	AcerPower P166	Acer America Corp.	138
962	AHA-3985W MultiChannel RAID Adapter Kit	Adaptec Inc.	NE51
975	Air Apparent for NetWare	Motorola	NE55
975	Air Apparent for Windows NT	Motorola	NE55
434	AirCommunicator Lite	Air Communications	60
490	Aironet Arlan	Aironet Wireless Communications Inc.	181
975	AirPower	Motorola	NE55
430	AKS Bass Pump	AKS Acoustics	69
966	AlertPage 2.0	Denmac Systems Inc.	NE52
953	ARCserve 2.01 for Windows NT, Enterprise Edition	Cheyenne Software Inc.	NE6
420	ArtiScan Pro 6000C	Tamarack Technologies Inc.	76
491	AT&T WaveLAN	AT&T Network Systems	182
429	AuthorSoft 3.1	Spirit of St. Louis Software	63
961	Aviator	Momentum Microsystems Inc.	NE51
954	Backup Director 4.0, Windows NT Edition	Palindrome Corp.	NE12
955	Backup Exec for Windows NT	Arcada Software Inc.	NE18
421	Barcode Anything	Zebra Technologies VTI Inc.	80
951	BitSurfr Pro	Motorola	NE47
492	BreezeCOM BreezeNET	BreezeCOM	186
457	Caliber Voyager III 150	Caliber Computer Corp.	143
414	callunacard	Calluna Technology	75
427	Canon NoteJet IIIcx	Canon Computer Systems Inc.	43
956	CDexecutive 1.1	Logicraft Information Systems Inc.	NE49
971	CiscoPro CPA120	Cisco Sysms Inc.	NE54
422	Citizen PN50 Portable Printer	Citizen America Corp.	80
431	ClickBook 2.0	Bookmaker Corp.	69
406	CommEx 1.20	Cottonwood Software	44
445	Compaq DeskPro XL 6150	Compaq Computer Corp.	112
458	CompuTrend Premio Triton P166	CompuTrend Systems Inc.	150
459	Comtrade 3D Game Station 8X	Comtrade	150
417	Conversions Plus Version 3.5 for Windows	DataViz Inc.	76
964	Darter-10	Matrox Networks	NE51
952	dd.400	Xistor	NE48
446	Dell Dimension XPS P166c	Dell Computer Corp.	152
446	Dell Dimension XPS Pro150	Dell Computer Corp.	114
447	Digital Celebris GL 5166	Digital Equipment Corp.	152
447	Digital Celebris XL 6150	Digital Equipment Corp.	114
493	Digital RoamAbout	Digital Equipment Corp.	191
448	DirectWave Blue Thunder PD150	DirectWave Inc.	127
435	Dr. Solomon's Anti-Virus Toolkit for Windows 95	Software International Inc.	40
462	DTK QUIN-54M/P150	DTK Computer Inc.	153
462	DTK QUIN-54M/P166	DTK Computer Inc.	153
960	EM110 T4 PCI	Cogent Technologies	NE43
464	EPS Evolution P-166	EPS Technologies Inc.	153
405	FrontPage 1.0	Vermeer Technologies Inc.	44
465	Gateway P5-166 XL	Gateway 2000 Inc.	154
415	HotDocs 3.0	Capsoft Development Corp.	76
401	HP DeskJet 340	Hewlett-Packard Co.	51
449	HP Vectra XU 6/150	Hewlett-Packard Co.	127
486	Hurricane 1.02	Helix Software	209
450	IBM PC 330 with Pentium Pro Processor	IBM PC Co.	130
450	IBM PC 350-P166	IBM PC Co.	155
494	IBM Wireless LAN Entry	IBM Corp.	192
408	IncreMeg 2.0 GB drive cartridge	MountainGate Data Systems Inc.	56
408	IncreMeg 4.1 GB drive cartridge	MountainGate Data Systems Inc.	56
408	IncreMeg full profile Docking Station	MountainGate Data Systems Inc.	56
410	Informer 1.5	Reportech Inc.	54
424	Inside the GMAT	The Princeton Review Publishing	80
424	Inside the GRE	The Princeton Review Publishing	80
424	Inside the MCAT	The Princeton Review Publishing	80
972	i2i videoconferencing system	IPC Peripherals Inc.	NE54
441	Kiplinger TaxCut	Block Financial Corp.	309
976	MA8NWC/HD MiniArray	Multi-Tech Systems Inc.	NE55
976	MA8CWF/HD	Multi-Tech Systems Inc.	NE55
487	MagnaRAM 2	Quarterdeck Corp.	210
963	Max 1800	Ascend Communications Inc.	NE51
451	Micron P150 Millennia	Micron Electronics Inc.	156
451	Micron P166 Millennia Plus	Micron Electronics Inc.	156
451	Micron Pro 150 Magnum Plus	Micron Electronics Inc.	131
409	Microsoft Internet Explorer 2.0	Microsoft Corp.	54
452	MITAC Performance Pro-32	MITAC	131
469	Mitsuba Premier System 166	Mitsuba Corp.	157
407	MultiSpin 4x4	NEC Technologies Inc.	56
426	Near & Far Author for Microsoft Word 6.0	Microstar Software Ltd.	75
453	NEC PowerMate P166	NEC Technologies Inc.	158
453	NEC PowerMate Pro150	NEC Technologies Inc.	131
959	NetSuite Professional Design	NetSuite Development	NE46
968	Network Health-Bay Dialogs	Bay Networks	NE53
969	Network Health-Bay Dialogs	Concord Communications	NE53
965	NetXRay 1.1	Cinco Networks Inc.	NE52
436	The Norton AntiVirus for Windows 95	Symantec Corp.	40
958	The Norton Enterprise Backup, Version 1.5	Symantec Corp.	NE12
957	Octopus 1.5	Octopus Technologies Inc.	NE13
418	PartitionMagic Version 2.0	PowerQuest Corp.	76
437	PC-cillin 95, Version 1.0	TouchStone Software Corp.	40
471	PerComp P166 Professional	PerComp Microsystems Inc.	158
974	Permit 1060 Security Gateway	TimeStep Corp.	NE55
442	Personal Tax Edge	Parsons Technology Inc.	321
403	PlanMaker 2	PowerSolutions for Business	66
404	PowerDesk	MicroHelp Inc.	66
472	PowerSpec*PC Reference Series P166	PowerSpec	158
416	Power2Play	The Software Labs	76
419	Primax DeskScan Color	Primax Electronics	76
428	Print House for Windows 95	Corel Corp.	63
495	Proxim RangeLAN2	Proxim Inc.	196
402	PSA Cards 2.61	PSA Software	51
487	QEMM 8	Quarterdeck Corp.	210
412	QModemPro for Windows 95	Mustang Software Inc.	75
473	Quantex QP5/166 SM-2	Quantex Microsystems Inc.	163
488	RAM Doubler 1.02	Connectix	211
496	RDC PortLAN	RDC Networks Inc.	200
474	Reason Square 5 LX-TR/1E-150	Reason Technology Inc.	163
474	Reason Square 5 LX-TR/1E-166	Reason Technology Inc.	163
967	Remote LAN Node (RLN) 4.0	Attachmate Corp.	NE52
476	Robotech Cobra XLT P166	Robotech Inc.	164
477	Royal Ultra Media-15	Royal Computers Inc.	165
970	Saber LAN Workstation (SLW) 5.5	McAfee	NE54
973	SafeNet	Information Resource Engineering Inc.	NE55
478	SAG STF 150	SAG Electronics	169
478	SAG STF 166	SAG Electronics	169
440	Score-Rx MultiPrep for the GRE/GMAT/LSAT	Xenon Educational Systems Inc.	80
440	Score-Rx TwinPrep for the SAT/ACT	Xenon Educational Systems Inc.	80
970	ServerStor	McAfee	NE54
443	Simply Tax	4Home Productions	322
433	SmartSuite 96 for Windows 95	Lotus Development Corp.	48
489	SoftRAM95 2.0	Synchrony Software	211
497	Solectek Airlan	Solectek Corp.	203
960	S-1200 T4 Repeater	Cogent Technologies	NE43
454	Sys Performance P166T	Sys Technology Inc.	169
454	Sys Performance Pro 150	Sys Technology Inc.	133
438	ThunderByte Anti-Virus Utilities Professional Version for Windows 95	TCT ThunderByte-International	41
444	TurboTax Deluxe	Intuit Inc.	330
482	USA Flex PT-166 Ultimate Multimedia Tower	USA Flex Inc.	169
481	US Computer Patriot LX 166	US Computer Direct	170
483	Vektron Home Office Pro-P150	Vektron	173
411	Virtus WalkThrough Pro Version 2.5	Virtus Corp.	75
439	VirusScan for Windows 95	McAfee Associates Inc.	41
970	WebScan	McAfee	NE54
425	WebWare for the SAT	Stanford Testing Systems Inc.	80
413	WinBook XP5 P120	WinBook Computer Corp.	75
432	Wise Installation System 4.0	Great Lakes Business Solutions	69
498	Xircom Netware	Xircom Inc.	204
423	Your Personal Trainer for the GRE	Davidson & Associates Inc.	80
455	ZDS Z-Station GT	Zenith Data Systems	173
455	ZDS Z-Station GT Pentium Pro	Zenith Data Systems	133
485	Zenon Dream Media P-150	Zenon Technology Inc.	173
485	Zenon Dream Media P-166	Zenon Technology Inc.	173

NE—Network Edition.

To obtain the Network Edition of *PC Magazine*, call Circulation at 800-289-0429.

Abort, Retry, Fail?

THE LIGHTER SIDE OF PERSONAL COMPUTING

By Don Willmott

ARF on the Road with Windows 95

Ever since Windows 95 came out last August, intrepid ARF readers armed with cameras have been hunting high and low to prove an important point about business: when marketing runs amok, comedy is the inevitable result. Just look at these snapshots.

The Lusty Lady  is a famous Seattle landmark, conveniently located just 30 minutes from Microsoft headquarters. Hey, you never know where programmers will find their next big ideas.



The last picture  show? Maybe not. It looks as if Windows 95 is giving Culpepper, Virginia's State Theater a new lease on life. Multithreading matinees play every Saturday at 2:00.



Spell-Check Double-Check and Double-Check Again

Faithful reader Doug Woodring was typing a letter for the company president. In the final sentence, "Our greatest frustration is the time it takes to go from idea to completion," he accidentally dropped the "m" from the final word. No big deal, right? Well, it was a good thing he took another look after spell-checking the letter. Without ever raising a flag, Microsoft Word for Windows had changed the last word to copulation.



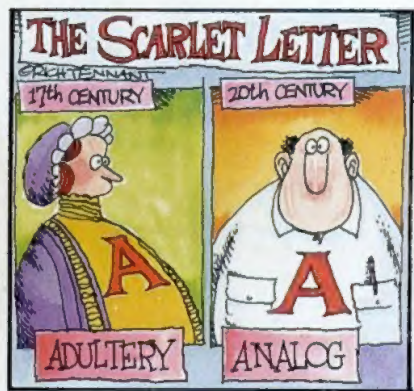
 Verily we say unto you that down in Houston, Reverend Culbertson was certain to gather a large flock with a sermon like this.



 Way out in Savona, British Columbia, life's pleasures are simple: pretty mountains, a glistening lake, a muddy pickup truck, and Windows 95. Anybody got a cold six-pack?



 How much do you want to bet that this Philadelphia computer store hired some Mac fanatics and then gave them the job of hanging the Windows 95 posters?



RICHARD TENNANT

If your entry is used, we'll send you \$50 and a *PC Magazine* T-shirt. Send your entries to Abort, Retry, Fail?, *PC Magazine*, One Park Ave., New York, NY 10016-5802. Winners this issue: Eric Cheng, Thomas Frederiksen, Ken Goodman, Edward Ngo, Louie Tsiktsiris, and Doug Woodring.

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Pricing is not discountable. *The VeriTest Cross-Country v2.0 test simulates typical executive use of Microsoft Office® applications in Microsoft Windows® 3.11 during an airplane flight. Power management was enabled and 8MB RAM was installed. VeriTest, inc. is located in Santa Monica, CA.

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In search of the perfect PC? Just ask *Business Week*. In its First Annual Computer Buying Guide, the Dell Dimension XPS P133c was rated #1 among the "Best Bets for PC Buyers."

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